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EDITORIAL

PLANS FOR GOOD TIMES

The fiftieth volume of MUNICIPAL ENGINEERING will complete this year and the first number of the year indicates what the advance of the fiftieth volume over the first volume may be. Times have changed in twenty-five years and the magazine has changed with it. A new energy has shown itself in all departments of industry and it is showing itself in the conduct of this business in a manner which will become more evident as the great year of this country unfolds.

Plans have been made to serve the needs of all classes of our readers with material to suit their needs. The editor is continually asking for suggestions and any one whom he has failed to reach is invited to add his requests, which will be worked into the program as opportunity offers. The question department is always open for service to subscribers and they are invited to reciprocate with brief articles on design and construction with which they have been connected, in which others would be interested. We all of us want to know what the others are doing and how they are doing it.

The engineer is interested in the design of works, in specifications, in statements of cost which can be used as aids in making his estimates, in descriptions of new materials and methods, and as always, articles a little in advance will be found here showing what the prospects are, as well as later full descriptions of plans and of the completed work.

The operating engineer and the city official in the management of public utilities is interested in the solution of his problems of operation and maintenance and in the methods of economical management and he will find much to aid him. If his particular problem is not touched he is invited to state it and if not already in the program it will be put in.

The contractor is interested particularly in methods and costs of construction, in machinery and apparatus, and he will find the modern developments set forth in some detail.

The automobile truck, in particular, promises to be the great development of the year and the number in use will multiply rather than be added to. The series of compilations of information in this line, which has been running for several months, will be made more definite and complete as experience by more users adds to the stock of information as to methods of use, cost of operation and economy of management. Heretofore the data have been very fragmentary but the weak spots are being filled and the growing demands of contractors for reliable and detailed information about the possibilities of the new motive power and the methods of realizing them will be satisfied as rapidly and completely as possible.

The student and the engineer who is working up a subject will not be forgotten, the descriptive lists of books on municipal engineering subjects, of which one is given this month, being one indication of the service he will be given.

The news of the field will be given as only a monthly can give it, preserving the material of value and giving a birdseye view of the business of contracting and the business of engineering and the business of supplying the engineers and contractors with the materials and apparatus they require, as well as the important personal happenings and the news of the gatherings of men of the same interest together to discuss their common problems.

All together, the magazine will do its best to keep just a little in advance of the procession, no small job in a year when the movement forward will be the most rapid and the most widespread which the country has ever seen.

ROAD SCHOOLS

The brief road school in the winter which began practically with the graduate school at Columbia University, was taken up by the engineering and agricultural departments of the State universities two or three years ago and has developed into a real source of instruction for the men directly interested in the construction and repair of roads. Fully eighty superintendents, commissioners, supervisors and engineers of highways, with additional prospective employes of highway departments, attended the road school of the University of Illinois and even a larger number that at Purdue University in Indiana held in January and Michigan, Wisconsin and Iowa were not far behind. The Indiana county highway superintendents, ninety-two of them, have a State association which meets in connection with the road school. While the time spent at the school is short the instruction is special, expert, and concentrated and touches the real problems of the attendants and is productive of much good. Experience is improving the schools each year and they have become a necessity.

IMPROVEMENT OF RIVER BANKS
OF HARRISBURG, PA.

By Farley Gannett, Consulting Engineer, Harrisburg, Pa.

American cities, most of them, have been too busy to look after the beautifying of the water courses passing thru them and fell into the habit of considering them as necessary evils. Harrisburg, Pa., was one of the first cities to undertake the improvement of its water courses, large and small, and, tho a small city has made long strides toward making the banks and the streams beautiful as well as putting them in sanitary condition.

The author of this paper was directly connected with the work in some of its stages and describes it from intimate knowledge of what has been done and what is still in mind for future development.

Harrisburg has one asset, the Susquehanna River, which is greater than many cities can claim, and the pictures show how the city is first improving the physical condition of its banks, second, the stream itself and, to follow, the beautifying of the banks to conform with the beauty of the regulated stream.

MOST streams of importance in Pennsylvania are made "public highways" by law, and as such are as free to travel and use by the public as country roads or city streets. But seldom does the public care for them to keep them adequate and in proper condition as it does the streets. The average small stream which passes thru a town is foul and ill-smelling, an eyesore and breeding-place for disease; while its channel is usually too small, due to encroachments by bridges, culverts and abutting properties, to carry off floods. This is equally true of many large streams, which, instead of being agents for the promotion of industry, comfort, beauty and pleasure, are positive detriments to the towns thru which they pass. Add to this their liability to rise in uncontrolled flood, causing great destruction of life and property, and what should be an ally of inestimable value, becomes a scourge.

Factories and mills naturally seek the water's edge to obtain short intake lines to the stream or to be adjacent to the railroad. This proximity to the stream has also the "advantage" of offering a convenient dumping ground for waste material, which, when thrown over the bank, are washed away by the floods (leaving room for a fresh supply) to form shoals at points below. Where there are no railroads or industrial works, it is most astonishing that civic pride and economic considerations do not cause advantage to be taken of the potential beauties and uses of the streams. But even when these drawbacks exist, the banks and channels can often be attractively improved.

There is seldom any such attempt to control and guide the flow of water in streams other than the irregular banks as nature made them and as man has encroached upon and narrowed the channel without regard to the necessities of the situation. But when the stream flow is obstructed the only alternative for flood water is to rise out of the channel and pass thru the town carrying devastation with it, as did Mill Creek, at Erie, Pa., on August 3, 1915.

Two striking examples of stream treatment and lack of treatment by Pennsylvania cities may be cited. One, where nothing was done and the loss of thirty-four lives and $2,000,000 of property resulted. The other, where a few hundred thousand dollars has not only prevented such an occurrence, but has converted the waterways which pass by and thru the city into valuable assets. The one is Erie, the other Harrisburg.

In the night of August 3, last, Mill Creek, which passes for nearly three miles thru the heart of Erie, rose in flood and tearing out over a score of bridges, 200 houses and other buildings, laid waste an area of two and a half miles long and from one to three blocks wide. Corrective measures are now being planned and will probably be adopted, for twice before has similar, altho not so extensive, damage been wrought by this stream.

Previous to 1902, Harrisburg, the capital city of a great state, beautifully situated on the Susquehanna river, had apparently failed to appreciate some of its greatest advantages or to foresee the potential dangers in its streams. It lies on the east bank of the river, twenty-five to thirty feet above low water. Paxton Creek comes westerly from the hills, turns south at the upper limit of the city and for some distance runs parallel to the river, which it joins at the lower end of town. For years these streams remained, from almost every point of view, a menace to the city.

The water supply, which was pumped direct from the river, was black with coal dirt and laden with disease. Frequent floods inundated certain sections of the city, and by eroding the banks, endangered the street along the river front. The current was too swift for pleasurable boating or swimming, and in dry seasons the water was too shallow for either. At every street intersection with the river and creek, a sewer discharged, the effluent from which was carried along the whole length of the city, so that in dry weather, living on, or even walking along, the banks was most unpleasant. Malaria was rampant. Residents in the vicinity dumped ashes, paper, and even garbage, over the banks.

Paxton Creek passes for two miles thru the city, above which for two miles more its course is in a mosquito breeding swamp. Its banks were periodically flooded, considerably damaging certain low sections of the town. In the dry season its flow was largely sewage, its banks were vile, and it was a locality to be shunned.

The Civic Club of Harrisburg, composed of its most public-spirited citizens, both men and women, gave much thought to the matter from the beginning. The interest of the whole community was aroused, and in 1902 a bond issue of $1,000,000 was authorized by the city. The services of a consulting engineer of international reputation and of a prominent landscape architect were engaged, and a plan was adopted covering the great improvements that have since been carried out.

The first work done was to build a large concrete sewer, three miles long, to take the sewage out of Paxton Creek and carry it to the river below the city. This sewer was constructed in 1903 at a cost of nearly $200,000.

PAXTON CREEK *when it was a neglected open drain thru the heart of Harrisburg; photograph taken in the summer of* 1913.

PAXTON CREEK *after it had been regulated, giving a concrete-lined channel designed to carry the low-water flow and also the flood flow, and to be self-cleansing under both conditions. The section shown is along the railroad, but there is evident opportunity for beautifying the adjoining ground and thus giving the transient traveler on the passing train a pleasant memory of the city.*

Then came a filtration plant to purify the water. This plant, which was built in 1904-5 on an island in the river, cost a little over $300,000; it removes all the coal dirt, and about 99.7 per cent. of the bacteria, so that Harrisburg now has an ample, pure and attractive water supply.

Next, a flood storage reservoir was built on Paxton Creek, submerging a portion of the swamp two miles long and about a thousand feet wide. To form this reservoir an earth dam eight hundred feet long and about twenty feet high, was built, at a cost approximating $100,000. The control of the floods permitted the reclamation of the rest of the swamp below the reservoir, and the whole area is now included in the nine hundred acres of city park. The reservoir is so large that it prevents floods in that part of the creek which passes thru the city below, by retaining the water and allowing it to flow down gradually when the flood has subsided.

The lake formed by this storage offers delightful recreation to the people of the city at all seasons; a municipal boathouse holds numerous row boats and canoes, which are in demand during the summer, while in winter the skating is often good and the ice kept in condition by the city.

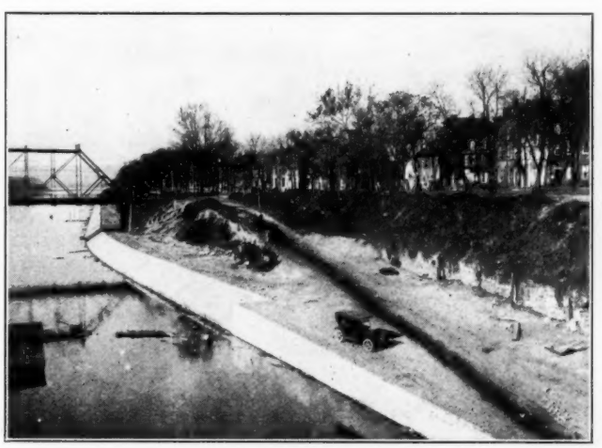
A second bond issue in 1911 made possible further improvements. In 1912-13 a concrete sewer was constructed the whole length of the city along the river front, with which all the sewers in the cross streets, previously flowing into the river, were connected. This sewer empties into the river at the lower end of the city, at the same point as the Paxton Creek sewer, so that practically all the city sewage is now gathered at one point to facilitate its purification at a sewage disposal plant soon to be built. With the construction of this sewer, at a cost of $125,000, the foul smell from the river has disappeared and the beautiful residences along the shore are no longer deserted when summer comes.

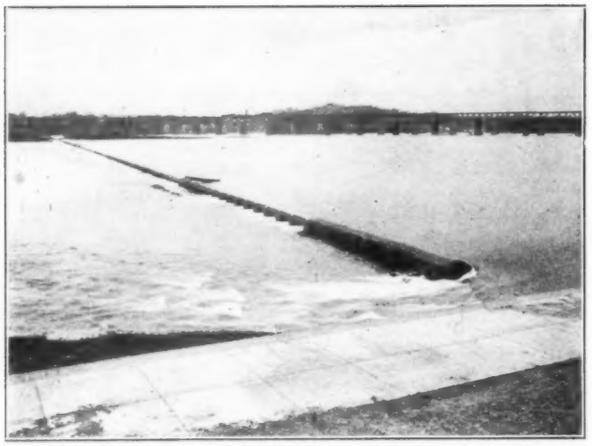
The brush-lined, irregular, filth-covered channel of Paxton festered, has been excavated to an even grade and smooth lines and faced with concrete. It is now a smooth-flowing stream in a clean and attractive channel in which floods are unknown.

The last thing in the scheme of municipal improvement was the building of a concrete wall, ten feet high, in the form

THE SHORE OF THE SUSQUEHANNA RIVER *when all the attention it got was from the residents along the parallel street and the casual city official seeking their good opinion.*

THE REGULATED BANKS *of the Susquehanna River, with vertical or stepped concrete wall protecting the shore from flood wash and giving a basis on which to found a landscape treatment of the banks above, which will make of them a continuous park and boulevard.*





THE DAM ACROSS *the Susquehanna River, which converts two miles of river front into a beautiful summer lake resort.*

of steps, along the low-water river line, for two and a half miles, with a fourteen-foot concrete walk at the top level. The bank above has been carefully graded and planted with shrubs and vines. The construction of this permanent bank at a cost of about $200,000 is not only a needed protection to the river front, but is a much appreciated addition to its attractiveness. The walk is much used by pedestrians and from it one gets an unobstructed view of the sun setting across the mile-wide, island-dotted river, with its background of wooded hills. The steps are used in going to and from row-boats and canoes.

A 4½-foot dam, three-fourths of a mile long, across the river, at the lower end of the city is now being built. This will give correspondingly deep and slack water along the river front for over two miles. Canoes have multiplied many fold in prospect of the early completion of this dam, which will eliminate the swift current and danger from rocks and shallows. Bath-houses will soon be built, and thousands of people will be able to enjoy this great lake.

During all this time, the city was acquiring, by gift and purchase, the land between the river and the west side of the street paralleling the shore, and converting it into a beautiful park. The last stretch of three blocks is now being condemned and purchased and the houses will be removed. This will give complete municipal ownership of the entire three-miles of river front, all converted into parkway bordering the river boulevard.

The financial cost of this whole work, including sewers, filters, storage reservoir, improved creek channel and river wall, and including remodeling much of the street sewer system, a great concrete viaduct and other minor works, engineering and administration, has been about $20 per capita of the 75,000 population, and a little over $1 a year per capita to pay interest and sinking fund on bonds. But this does not include the value of the time and thought that have been given to the work by the people of Harrisburg, who may well be proud of the result. The administration of all these works has been in the hands of a board of public works, whose members have been men of large affairs, who have given their time to the city without financial reward.

Harrisburg has been transformed and today few cities in Pennsylvania, perhaps in the whole country, have a more attractive water side, or better sanitary conditions in general. Of course, this great work, the pride, not only of the city, but of the state, was not accomplished without a large expenditure of time and money and it was all done by the city itself, without state aid. A city once shunned in summer as a typhoid, malaria-ridden place, has become desirable for summer residence, an ideal city of homes. With its public golf course, a dozen or more public tennis courts, numerous public playgrounds and nearly 1,000 acres of parks, it keeps its citizens well and happy and attracts many from elsewhere. Furthermore, the increase in assessed value of city property has been so great as to permit carrying on all governmental activities and paying interest and sinking fund charges on these improvement bonds without increasing the city tax rate.

CONNECTING ELECTRICAL CIRCUITS TO WATER PIPES

Contrary to the former teachings regarding the necessity of preventing the collection of electric currents by water pipes and the dangers of electrolysis where the currents leave the pipes are the conclusions reached in a paper before the Central States Water Works Association, by Burton McCollum and O. S. Peters. The paper gives the data and the theory upon which the conclusions are based, the latter being stated in brief as follows:

1. Many of the dangers which arise from electrical circuits may be eliminated by earthing these circuits.

2. Of the means of earthing electrical circuits water pipes are by far the most desirable.

3. There is no danger of electrolysis by such stray alternating currents as may result from earthing low voltage alternating current circuits.

4. Direct current circuits should be earthed at but one point, preferably at the station.

5. Where conditions permit two or more, ground connections should be made on each secondary system.

6. In case of any individual low voltage circuit in which a number of earth connections to pipes are made, the earthing should be confined to one pipe system. Measurements of the resistance of the pipe line between the farthest removed points of connection should be made to make certain there are no insulating joints in the part of the pipe line which may cause the electric circuit to carry heavy stray currents from railways.

7. In making either single or multiple earth connections to water systems, unless it is positively known that there are no insulating joints near by, the adequacy of the earth connection should be determined by measurement of its resistance. Earth connections should not be made to cement joint lines, or other lines in which there are many joints of high resistance.

8. Connection to pipe lines may be made by screwing a brass plug into the bell in the case of cast-iron pipes or by clamps or soldering to service pipes. Soldering is preferable to clamps where it is possible to do it.

9. Earth connections to service pipes should be made at the point where there is the least likelihood of the pipe being disconnected between the connection and the main. If the water meter comes between connection and main a jumper of the same size as the ground wire should be put around it.

10. Earth connections to gas pipes should be prohibited chiefly on account of the chance of explosions or fires, and also because the almost invariable presence of water pipes makes such connections unnecessary.

11. Because of the great advantage to the public and the slight disadvantage, if any, to the public service corporations resulting from earthing to water pipes, such earthing of secondary systems should be made compulsory.

SYSTEMATIC SNOW REMOVAL
IN NEW YORK CITY

The removal of snow is an occasional job which has never had the attention it deserved until a genius in organization was put in charge of the street cleaning department in New York. J. T. Fetherston, the Commissioner of Street Cleaning, has worked out his detail of organization from registration of the necessary extra employes and provision of notice when their services are required to their payment within a few hours after their work is done, so completely that it worked almost to perfection the first time trying. Street commissioners in the smaller cities now have a model to follow which covers the ground so completely that they can scarcely find a local condition which is not taken care of. Instead of being proud that they have helped the sun get the snow off a few hours earlier than it might, unaided, they are shown how to get the snow off almost as it falls and at less expense than by the old methods.

THE removal of snow from city streets is an emergency undertaking, which requires mainly a strong organization ready to take up the work at a moment's notice, and large enough to complete the work in the shortest possible time. That the expense of preparedness shall not be prohibitory, the standing organization must have as few men, animals, wagons and machines fitted only for snow removal as possible, and must be able to call for a maximum of assistance from other departments.

Fortunately, with full co-operation of departments, these requirements can be met. The additional machinery necessary can be limited to the snow plows, scrapers, unloaders and the like, which will not be excessive in cost nor will they deteriorate in storage if properly protected from the weather.

The street cleaning and street maintenance departments are temporarily put out of business by the snow-fall and all their men, animals and machinery are available for the snow removal work. Garbage and refuse collection is also greatly interfered with and may be stopped altogether for a day or two by exceptionally heavy snow-falls, so that the equipment of that department can also be used during the early stages of snow removal.

The principal requirement for prompt and effective work is therefore a thoro preliminary organization of the forces available, each group of men and machines being instructed in advance as to its duties and place of operation, and the foremen being specially instructed as to the methods of operation peculiar to snow removal as compared with their regular duties.

With superintendent or superintendents on hand who are experienced in snow handling and full arrangement made for extra hours, call to duty at any time of day or night and a continuing provision for extra help, which must, of course, be kept closely in view, the work of snow removal can begin promptly as soon as the snow-fall is heavy enough to handle and continue with the storm and after until traffic conditions are again normal or nearly so.

The Commissioner of Street Cleaning of New York City, J. T. Fetherston, has worked out a system practically along the lines laid down above and for the following descriptions of them we are indebted to various papers and reports by him and his department.

This is the problem:

A heavy snow-fall retards traffic, causes unknown losses, not only indirectly, thru wasted time, services and delayed deliveries of merchandise, but also thru direct accidents or injuries to animals, pedestrians, cars or vehicles. The fire risk increases with the severity of the snow storm and under abnormal weather conditions might even imperil the whole city. Public health is menaced thru delayed removal of dirt and filth-impregnated snow. Pavements are damaged by the concentration of traffic between snow banks.

During February and March, 1914, New York experienced the worst snow period in twenty years. Over thirty-eight inches of snow was deposited by nine successive storms and temperatures remained below the freezing point most of the time during the forty-four days, while snow was being removed from the streets. This work cost the city directly about two and one-half million dollars and resulted indirectly in inestimable losses to the community. No large fires occurred during the period when street traffic was blocked and this fortunate circumstance alone prevented a possible calamity.

The old method of removal was by carts to dumps on the docks with a few sewers in use. Further experience with sewers as dumpers for snow demonstrated that:

1. Under ordinary conditions, snow will melt in a sewer within 300 feet from the point where it is dumped.
2. The theoretical number of B. t. u. necessary to melt snow checks the actual tests in sewers.
3. Two cubic yards per minute was found to be the maximum rate at which it is possible to shovel snow into a 24-foot diameter sewer manhole.
4. There is much more heat in sewage than is necessary to melt within 300 feet all the snow that can possibly be dumped into manholes.
5. Syphon sewers carry snow away as well as others.
6. Many sewers exist in Manhattan Borough which have never been used for snow disposal but which are as able to carry snow away as those that have.

Melting snow by various proposed methods was estimated from data secured to cost at least 55.2 cents a cubic yard using steam; 45 cents using electricity, and 28½ to 51.8 cents per load with coke and naphtha, without fully considering the cost of keeping the vast plant necessary in continuously good condition for immediate operation, and the hauling of the thousands of tons of coal necessary to serve the boro of Manhattan, and hauling out the many tons of resulting ashes.

Plans for the fight against snow were based on certain assumptions as follows:

(1) That a sufficient force of emergency labor could be started at work, day or night, within four hours after a continuing snowfall began.

(2) That a rate of pay sufficient to attract labor and make the men anxious to work would be offered by the city.

(3) That the weather conditions would not be so extreme as to prevent men from working during the storm.

(4) That a sufficient amount of normal sewage was flowing in the bulk of the sewers to transport snow to the rivers and harbor.

(5) That the ordinary flow of sewage could be supplemented by water from hydrants where the normal flow was insufficient to transport the snow.

This program involved a survey to determine what sewers could be used, the location of the available manholes on them and the places where the sewer flow should be aided by hydrant streams to keep the snow moving; weather conditions past and probable, based on close study of the United States Weather Bureau records; registration of laborers who could be called upon for the extra work required and methods of notifying them; assignments of men to gangs with time and place of reporting for work; the organization of police and street cleaning department regular employes to deliver the notices promptly; the provision of enough pan scrapers, road scrapers, scoops, plows, picks, etc., of the department standards to keep the men available in continuous employment and to furnish them promptly at the required localities; rates of pay necessary, time and overtime being paid at regular rates, with a 50 per cent bonus to regular employes for completion of the work within fixed time limits, and 30 cents an hour for regular work with 10 cents additional for completion of work within specified time limits to emergency men; assignments of clerks, inspectors, checkers, etc., from other departments to the snow-fighting force with an increase of 50 per cent of their regular pay for such work, these provisions for extra pay being the most important of all the plans for securing men promptly and insuring good and rapid work; methods of securing co-operation of citizens with the department in the work.

The organization of the street force was in three divisions:

(1) The first line of attack comprised regular street cleaning employees, supplemented by emergency laborers. The unit of organization was based upon the sweeper as leader of a squad of emergency laborers, working under the direction of regular department officers.

(2) The first reserve consisted of regular department drivers with horses and carts, drafted for a night shift, to clear streets where the snow fighting force could not use the sweepers.

(3) The second reserve consisted of private trucks for day or night service, used as a supplementary force when the two regular forces were unable to cope with storm. This reserve force was covered by the registration of private vehicles to be assigned according to the requirements of the situation.

A summary of results obtained in 1914-15 by comparison with plans and previous records shows greatly increased speed of removal with reduced cost:

A. On truck capacity basis of removal:
   Rate of removal per day increased 4.71 times and cost per cubic yard decreased 77.3 per cent compared with average results between 1907-1914.
   Rate of removal per day doubled, compared with the best previous record (1914) and cost per cubic yard decreased 67 per cent compared with the lowest previous unit cost record (1908).

B. On area basis of removal (area streets surface multiplied by depth of snow), considering only the snow fighting force:
   Rate of removal per day increased 3.35 times and cost per cubic yard decreased 80 per cent compared with average results between 1902-1907.
   Rate of removal per day doubled and cost per cubic yard decreased 75 per cent compared with best season's unit cost record of 1906-1907.

The increased speed of removal and reduced unit cost should be credited to the new method of snow fighting, using sewers for disposal.

It was necessary to start working on three storms, with a combined fall of 22.4 inches, and the total cost of snow work for the winter was less than $523,892. If all snow in 1914-1915 had been handled by contractors' trucking forces alone, the season's work at the lowest previous contract rate ($0.367 per cubic yard in 1907-1908) would have cost $1,584,882. At the 1914-1915 trucking rate the cost would have amounted to $2,370,846.

Weather conditions after the snow storms, however, were favorable for dispersal by melting, and neither of the above amounts can be accepted as conclusive, yet a conservative estimate indicates that the new system saved the city at least half a million dollars.

The 1914-1915 snowfall was 2.9 inches less than the average, and the temperature was 1.6 degrees F. higher than the average for forty-six years preceding.

About 40,000 emergency laborers were registered for the snow fighting force in November and December. Notification cards were made out for the laborers and sorted according to police precincts. Cards were likewise prepared for all regular employees of the Street Cleaning Department, and for other city employes drafted for snow work. All cards were sent to the police stations in the precincts in which the men lived, and were sorted by patrolmen's posts for distribution when the Police Department was notified that snow work was to start.

The plan of calling the men to work was generally successful and the Police Department deserves credit for the rapid and effective work in calling out the snow fighters.

The responsibility for starting snow fighting work involved the exercise of judgment in determining whether or not a snow storm warranted action costing approximately $50,000 per shift. There were forty-five separate storms, of which nineteen contained snow. Practically all of the snow storms were of an uncertain character, so that it was not possible to start snow fighting when the storm began. This condition resulted in some delay in beginning work on the three storms on which work was done, but was repaid by the fact that no mistakes were made in starting unnecessary work.

Of the three working storms the first began on February 1, and falling temperature and the formation of ice on the pavement continued until 6:35 P. M. of February 2, during which time 1.9 inches of sleet and 0.5 inches of snow accumulated on the ground. Word was sent out to call the snow fighting force at 12 M. on February 2, and one shift started, finishing work at 1 A. M. on February 3. On February 3 and 4 another snowfall amounting to 2 inches made the total depth on the ground 4.5 inches of snow, ice and sleet.

The second working storm began at 5.25 A. M. March 6, and continued until 10.02 A. M. of March 7, during which time 7.7 inches of snow fell. The call to work was sent out at 8 P. M. March 6, and two shifts of emergency laborers were employed.

The storm of April 3 was entirely unexpected and made a record as the greatest April snowfall in the history of the local Weather Bureau—10.2 inches. The call for automobile snow plows was sent out at 1 P. M. April 2 and the call for emergency laborers at 3 P. M. Three shifts of emergency laborers worked continuously from 3 P. M. until 10 P. M. of the succeeding day, which was Easter Sunday.

The time allowed for calling out, assigning and actually starting snow fighting work thru the boros of Manhattan, The Bronx and Brooklyn was four hours, and the results indicated that it was feasible to turn out all men who reported within the time limit set. For the storm of February 1, 12,518 emergency laborers were provided with badges, tickets and

equipment, and at work on the assigned areas within four hours. The storms of March 6 and April 3 occurred on Saturday, and it was not possible to get a full quota of emergency laborers to report for work, but in each instance about 9,000 men were actually at work on the various streets of the city within four hours after the call was sent to the Police Department.

About 86 per cent. of the snow fighting work was finished within fifteen hours after the storm ceased, but disposal of snow piles by sewering on side streets was continued by emergency laborers for sixteen days. The snow fighting force removed eight times the amount of snow for practically the same cost as the trucking force.

By the use of hydrant water to supplement the regular sewage flow, even small pipe sewers were used to some extent, and of the area cleaned about 62 per cent. was actually covered by sewers used as compared with the 37 per cent. of the preliminary estimate.

Weather conditions were favorable for the work, but the prompt removal of the snow gave little opportunity for thawing weather to help in that removal.

Altho 40,000 laborers registered at the beginning of the season, men enough to fill all the assignments could not be obtained at the times of the three storms when they were needed. The upper west side district was specially short of laborers.

Very few gangs completed their work in time to secure the bonuses.

The police call for the men was very satisfactory.

The pan scraper used by the emergency laborers was fairly successful when not used as a shovel. There was but little extra equipment, it being purchased mainly from the regular department appropriation.

Automobile plows for opening up unscheduled streets and streets where the contract required them were generally successful, the damage to practically all the twenty-six machines in the first storm of dense snow and sleet resulting in changes in the design of the plows so that they stood up well in the April storm under heavy working conditions.

Only thirteen squad leaders received the 50 per cent. bonus and only 117 emergency laborers received the bonus rate for the entire winter, tho 30 cents an hour secured a reasonable tho not wholly sufficient supply of labor. The 50 per cent. extra compensation to men assigned from other departments was shown not to be excessive. The checking and verification system worked well and no irregularities were discovered. Men were paid on the day succeeding the end of the storm, 20,000 men being paid in five hours after noon of April 5, fifteen hours after the last shift finished work. The maximum compensation paid was $1.49 an hour to finance department gang checkers and the minimum was 19 cents to the same class of employes.

As compared with the average of the next preceding six winters, the first winter under the new plan showed the following results:

Average number of storms in which work was done, 3.5, as compared with 3 in 1914-15.

Depth of snow in working storms, 24.1 average, as compared with 22.4.

Day's work required to remove the snow, 37.5, average (8 to 46), as compared with 16.

Cubic yards of snow removed, 2,148,584, average (496,047 to 5,180,825), as compared with 4,318,481 in 1914-15.

Total cost, $1,146,574 (53.3 cents per cubic yard) average, as compared with $523,892 (12.1 cents per cubic yard).

Average cubic yards of snow removed per day, 57,296, average of preceeding six years as compared with 269,905 in 1914-15.

Sewers greater than 12 inches in diameter can be used as snow dumps if hydrant water is used to help the sewage flow and the snow is removed while clean, i. e., during the progress of the storm, and before rubbish accumulates in the streets.

The regulations made by the Sewer Department, Charles E. Gregory, chief engineer, for the use of sewers for snow removal are as follows:

Rules and Regulations for Panning Snow Into the Sewer Manholes

1. No manhole shall be open except when being used for the disposal of snow. Before depositing any snow in a manhole, the sweeper must see that the sewage is flowing free from obstruction.
2. A note shall be made of the approximate depth of flow in the sewer before the depositing of snow is begun.
3. Hose streams may be used to increase the flow in the sewers, and at as many points as may be served by the quantity of hose in the department. Additional hose may be borrowed from fire houses.
4. Careful watch shall be kept of the sewer, so that it will not choke from too rapid panning of snow, which should be shoved into the sewers at a uniform and continuous rate. Should the flow of the sewer fail to carry the snow away freely, panning at that manhole will be discontinued until the manhole has been cleared and the flow of the sewer restored.
5. Whenever the flow of the sewer or the water from the hose streams, or both, do not freely carry away snow after the panning has been discontinued, the District Superintendent of Sewers shall be immediately notified through District Headquarters and the snow piled near the manhole.
6. All snow deposited in the sewer manhole shall be free from sticks, stones, ice, cans, ashes, garbage, or other materials which would injure or obstruct the sewer in any way.
7. Should a squad be working over a trunk sewer, where the whole squad may be employed to clear the area about the manhole, one man shall constantly guard the open manhole.
8. All directions given by the District Superintendent of Sewers shall be implicitly followed.

MOTOR TRUCKS *fitted with snow plows, cleared unscheduled streets and certain streets for which their use was contracted, successfully, when the plow was made strong enough.*

9. No corporation, private individual, contractor, or any city department shall be permitted to dump snow in any manhole unless permission has been granted by the Commissioner of Street Cleaning and approved by the Engineer-in-Charge of Sewers.

10. The city contractors or other corporations or individuals who have permits for dumping snow in the sewers shall not be interfered with.

Rules and Regulations for Dumping Snow Into Sewers

1. Sewers designated for the dumping of snow may be used in two ways:

First—By dumping loads of snow directly into any manhole which has been designated for "dumping."

Second—By dumping snow alongside and shoveling it in at a uniform rate into a manhole which has been designated for "shoveling."

2. Before permitting the use of any manhole for the dumping or shoveling of snow, it shall be examined for physical defects, and the depth and rate of flow. If the flow is obstructed or the manhole is defective in any way, dumping shall not be permitted until the District Superintendent of Sewers has been notified and his consent obtained.

3. Dumping shall never be permitted at manholes not included in the list furnished by the Department of Street Cleaning and approved by the Engineer-in-Charge of Sewers.

4. An open sewer manhole shall never be left unguarded.

5. Whenever a manhole cover is removed it shall be placed on the sidewalk from which the snow has been removed, where it can be readily found and replaced as soon as the dumping is discontinued.

6. All snow deposited in sewer manholes shall be free from sticks, stones, solid ice, cans, ashes, garbage, or other material which would injure or obstruct the sewer in any way.

7. Keep careful watch of the sewer and do not allow it to choke from the too rapid dumping of snow. When continuous dumping directly into the manhole chokes the sewers, such dumping shall be discontinued until the sewer has resumed its normal condition and is free from snow. The deposits of snow into the sewers may then be continued, but the trucks shall be required to dump their loads beside the manhole and the snow shall then be shoveled into the sewer at such a rate as not to cause further clogging of the sewer.

8. Wherever a manhole has been designated for use of "shoveling," all trucks shall dump their loads beside the manhole from which place the snow shall be shoveled into the sewer at a continuous uniform rate, so as not to choke or obstruct the sewer.

9. Whenever shoveling snow into a sewer obstructs the flow so that the snow is not quickly carried away, shoveling shall be discontinued until the snow already in the sewer shall be carried away and the normal flow of the sewer has been resumed. Shoveling may then be resumed but at a slower rate, so as not to again obstruct the sewer.

10. Wherever the dumping or shoveling of snow repeatedly obstructs the sewer, the District Superintendent of Sewers shall be notified and he shall decide whether the use of such sewer or manhole shall be discontinued. All directions given by the District Superintendent of Sewers shall be implicitly followed, and then reported to the District Superintendent of Snow Removal.

The use of the sewers for snow removal did not materially increase the deposit in the sewer even though some of the snow dumped contained considerable dirt, ashes and garbage. There was evidence, however, of considerable physical damage to all sewer structures where compacted frozen snow was dumped in large quantities. It is believed, however, that the gain both in direct reduction of cost to the city for snow removal and to the public in the more rapid clearing of the streets far outweighs the expense of repairing the damage to the sewers.

The principal difficulties in handling snow in sewers, making the regulations necessary are:

The irregularity in flow of water, a cold snow finding the sewers with a minimum of flow, whereas a wet snow melting and running away in part as it falls, adds a quantity of water to the sewage which will carry away snow as rapidly as it can be dumped into the manholes.

Too rapid dumping of snow into sewers with small flow with the use of hydrant water to help carry it away may result in filling such sewers, usually small in size, with slush which produces stoppage and backing up of the water and sewage.

Heavy articles and large articles dumped with the snow produce stoppages, but dirty snow, even if very dirty, can be taken care of if not so accompanied, the floating snow and ice producing a scouring effect which carries ordinary sediment along.

The snow-fighting gangs are ignorant and pack manholes tight with snow. This does not interfere with the flow in the sewer, which breaks thru the snow below, but it takes the snow in the manhole a long time to melt out, so that the men must be trained not to dump the snow faster than it is carried away below.

The value to the city of the snow removal by sewers is so great that the sewer department will increase the minimum size of sewers and otherwise provide for their use for this purpose.

WATER SOFTENING BY FILTRATION

Dr. Robert Gans of the Royal Prussian Geological Institute has developed a synthetic hydrous aluminum silicate in combination with sodium which, when used as a filtration medium for hard water, exchanges its calcium and magnesium ions for the sodium ions in the silicate, transforming the filtration medium into a calcium silicate and the hardening salts in the water into sodium salts with the original acid radicals, thus reducing the hardness. The silicates, when saturated with lime and magnesia, are restored to the original sodium condition by forcing action in the opposite direction by means of a solution of common salt.

Robert N. Kinnaird, chief engineer of the Des Moines Water Company, has reported to the Iowa section of the American Water Works Association that he has been investigating a natural substance of the same nature by the use of which as a filtration medium he has been able to reduce a hardness of 300 parts per million to a reasonable minimum at a filtration rate of two gallons per minute per square foot of filter area.

Comparing the process with rapid filtration of water, Mr. Kinnaird estimates that the cost will not be materially greater than that of thoro filtration, except that the process of regeneration of the filter material will take longer than the ordinary washing of filters, and so a greater allowance for filters out of commission for regeneration must be made and therefore the original cost of the filter plant will be increased.

Dr. Edward Bartow of the Illinois State Water Survey has duplicated Mr. Kinnaird's results but apparently the process is not yet sufficiently developed to warrant full information regarding details of materials used or methods employed.

The Municipal Supply Department—I.

By Hugh M. Foster, New York City.

The purchasing agent is becoming almost as much the fashion in the municipal housekeeping force as the city manager, new agents being appointed almost every month. The city of New York has made the most detailed study of the duties of such a department, and the author of the articles of which this is the first on the principles underlying the New York system is examining inspector of purchase and supplies in the supplies department of the Bureau of Standards, under the Board of Estimate and Apportionment of Greater New York. He speaks with the authority of experience in the work and the plan he describes can be fitted to any conditions, reducing the amount of machinery and the number of employes to suit the smaller business of other cities.

THE list of cities which have recently established supply departments indicates a widespread interest in better and more economical service. These cities are Philadelphia, Baltimore, Washington, Atlanta, Pittsburg, Cincinnati, Cleveland, Dayton, Chicago, Memphis, Birmingham, Minneapolis, St. Paul, St. Louis, Cedar Rapids, Kansas City, Des Moines, Denver, Houston, Fort Worth, Huntington, Galveston, Los Angeles, Pasadena, Sacramento, San Francisco and Portland.

The justification for the purchase of supplies is the actual need therefor. Such needs should be recorded by accurate and ample statistics, and users of supplies should make their requests subject to the most severe scrutiny. To allow catalogs and other suggestive literature to get promiscuously into the hands of users of supplies only offers temptation for unnecessary requests. An office man who sees an illustration of a desirable electric fixture for his desk and immediately makes request on the electric department, simply wastes money. The waste of supplies is quite as apparent in such desires as it is in the throwing away of surplus. A garbage pail full of loaves of stale bread is an indication of the inefficiency of an institution; likewise, large cakes of ice standing on the sidewalk in summer.

The study of uses and the object to be accomplished should be carried on so as to maintain accurate knowledge at all times. The carpenter who orders clear white pine for making a clothes closet when No. 3 barn would do quite as well, is merely wasting the city's money. Requests have frequently been received for timbers as large as 10 by 10 of clear white pine, when yellow pine would have done just as well; and the clear white pine of that size costs about $125 a thousand, while the yellow pine costs $40. A good handbook on the uses and economics of lumber should be in the hands of every carpenter, and his requisitions should be made to comply strictly with the recommendations in such a book of instructions.

The natural temptation of the storekeeper and of users of supplies, even in small quantities, is to over-stock, and the antithesis of this in those who allow appropriations is to reduce to the condition of under-stock. Of the two evils, overstocking is the worse, because it happens more frequently and lasts longer. It should be noticed that the loss of interest on capital tied up in surplus stock is often a considerable item.

Waste of supplies after receipt is a large field for loss of money. This is especially apparent in the painting department.

The proper handling of requisitions in view of anticipation of needs and their conformity to standard specifications is the very corner stone of a good supply department. Requisitions should be made early enough before the actual time for the use of the supply, to permit the proper determination of quantity and quality to be ordered, to go thru the channels of local and general storekeeper to determine if the supply can be furnished from stock, and if not, to give the purchasing agent time to purchase to the best advantage of the city. Such time for the purchasing agent involves not only taking advantage of market fluctuations, but of assembling many requisitions for the same supply, so as to be able to buy in larger quantities and thereby obtain lower prices. All requisitions, no matter how small the quantities may be, should be written in strict conformity with the standard specifications. The purpose of standardization in supplies is for the uniformity of all articles used for the same particular need, to promote the use of one instead of many articles so as to buy in larger quantities and obtain better prices. These benefits are entirely obliterated if small, open market orders are written in lax or amateur phraseology, instead of strict, technical trade terms of standard specifications. It is folly to insist that large contracts shall conform to standard specifications and open market orders be exempt. Copies of all requisitions should be on file in the offices of the originator, the storekeeper and the purchasing agent, for the purpose of aiding investigation, leading to sound knowledge from all three points. Orders should, of course, follow the same method, not only for the purpose of affording knowledge of quantities and qualities previously used, but of informing the users of supplies and the storekeepers of the purchasing agents' methods, and where the supplies are to come from. By suggestion and criticism, the users of supplies and storekeepers effect a wholesome check upon the purchasing agent. The form for requisitions should be standard thruout all departments, and should in all cases give the following information:

Number.
Fund.
Charge Account.
Date.
User of Supplies.
Quantity.
Unit.
Articles (including full technical trade description).
Serial Number.
Standard Specification Applicable Thereto.
Quantities on Hand and Due.
Periodic Consumption.
Purpose of Use.
Approximate Value.
Order Number.

This information should be given for each and every item of supplies. Certification should be made as to the sufficiency of funds, and a certification from the proper official that the supplies requested are necessary.

Stores—Upon the proper administration of stores, from

the largest general storehouse of the city to the smallest stock of tools or supplies carried by the humblest workman, rests the success or failure of the supply department. The workman who carries one unnecessary or unsuitable article is as guilty of mismanagement, tho to so slight a degree, as the general storekeeper of a great storehouse for the entire city who carries unusable or surplus or old stock, or obsolete or scrap material. The object of the store, no matter how large or how small, is to supply the actual current need, and that only. Too strict a regulation and investigation of the method of stores cannot be installed.

Distribution—For the purpose of controlling distribution of supplies to the actual consumers, the fullest records of receipts and issues should be maintained. The purchasing agent and the storekeeper of a well organized supply department should have ample statistics to inform him at all times upon every item of supplies—how much for a given period each consumer uses. By constant investigation and inspection, these uses made by the consumers of supplies should be checked to determine that the supplies are really used and not wasted nor standing idly in stock.

Purchase, Bids, Orders, Contracts, Continuing Agreements, Specifications—While it is the natural desire of a storekeeper to get as much as possible of the best quality to supply the needs of those dependent upon him, it is the function of the purchasing agent to buy as little as possible and of the lowest quality and price to meet these requirements. By this condition of apparent opposition the one official acts as a beneficial check upon the other.

In the promulgation of bids, orders, contracts and continuing agreements, a strict, orderly procedure should be maintained, which will, at all times, encourage competition and obtain the best supplies needed at the lowest prices obtainable.

Searches for new sources of supplies should constantly be undertaken to bring in new blood, as it were, and to stimulate competition. The consummation of a contract for supplies requires the following procedure:

The preparation of contract requirements in items, quantities, etc.

The approval of specifications.

The approval of the whole contract by the legal officer of the city.

The approval of the financial aspect by the fiscal officer.

Advertising for bids.

The awarding of the contract.

The ordering of deliveries and the forwarding of copies of such orders to the general fiscal officer.

The receipt of the supplies, acceptance and storing.

Inspection.

Laboratory tests.

Checking bills and assembling and forwarding copies with orders to the general fiscal officer.

The preparation and signing of vouchers.

The audit of bills and orders by the department receiving the supplies.

The forwarding of the bills and orders to the general fiscal officer.

The audit of the same by him.

The preparation of the same by him.

The preparation of warrants by the fiscal officer.

The recording of vouchers in his records.

The signature of the fiscal officer, the treasurer and the mayor.

The payment of the claim.

This elaborate procedure applies, with varying modifications, to bids, orders, contracts and continuing agreements. That is, bids must be made in conformity with the procedure and forms prescribed by the auditing department. Open market orders should fulfill all the general requirements of a large contract, except the legal provisions. From the beginning to the end of the transaction of purchase, standard specifications should be adhered to. The bids or requests for bids by the purchasing agent on prospective dealers, and the orders for purchase, and the orders for delivery on contract, and the orders against a continuing agreement, should all be standard in form thruout all departments, and should give, in detail, the following information:

Number.
Date.
Requisition Number.
Fund.
Charge Account.
Dealer to Whom Order is Issued.
Point of Delivery.
The Item.
The Quantity.
The Unit.
The Article (giving full technical trade description).
Serial Number of Standard Specification.
Unit Price.
What terms of payment.
Certifications of the Necessity of Supplies and of Sufficiency of Funds.
Certification of receipt.

Delivery and Inspection—When all departments of the municipal government buy and receive supplies separately, that condition defeats economy in purchase, and quite as strongly militates against efficiency in inspection. Thruout the greater city of New York there are, at present, over 2,100 delivery points for supplies. It is obvious that such diffusion prevents anything like complete inspection of all supplies delivered. Inspection that is not complete in the sense of covering all places where supplies are delivered and all the supplies delivered at each place, merely offers the opportunity for an unscrupulous contractor to learn the place where and the supplies by which he can most easily evade inspection. The establishment of a general and central storehouse with the minimum of branch storehouses would concentrate deliveries and intensify inspection. An enormous monetary economy may be achieved by the concentration of deliveries. A contractor who is required to send out a truck and team for a few pails of white lead is under necessarily heavy expense, and must cover that expense by his price. If such supplies are delivered only in annual or semi-annual deliveries, the unit cost of trucking is enormously reduced and the city gets the benefit.

A complete system of records of inspection with appropriate certifications as to the time, place and name of the inspector passing the supplies should be maintained. The storekeeper and his subordinates at various institutions or branch storehouses, and the final recipient or consumer of the supplies, all act as a wholesome check upon inspections and will be quick to find fault with improper inspection. The officials should be in ready touch with the purchasing agent, and the auditor or the comptroller, to notify these higher officials of any laxity of inspections, and a prompt investigation should be made upon such reports. All deliveries should be accompanied by invoices or memoranda bills in quadruplicate. One copy should go to the final recipient, one to the general storekeeper, one to the auditor of the department concerned and one to the division of inspection. Such a method gives opportunity for settlement of dispute as to quantities at once without needless delays, which allow the contractor to blame the receiver of the supplies for shortages. Delivery slips, which are merely memoranda of delivery without prices, as in an invoice, should follow the same procedure.

A complete system of tracing deliveries should be maintained by the storekeeper, and he should daily report to the

purchasing agent all delinquencies. Dealers who are negligent in this respect should be discountenanced.

Obsolete and Scrap Material—Thruout the city all departments and sub-divisions of departments should forward to the general storehouse surplus, obsolete and scrap supplies. A monthly investigation of these items should be undertaken at all institutions and branch stores, and such regularly sent forward to the general storehouse for assembling there. By the rigidity with which this work is done, the city avails itself of selling such supplies at public auction in greater quantities, and therefore obtaining better prices. The general storekeeper should receive daily reports from all institutions and branch storehouses of any superfluity on hand, so that upon receiving a requisition for a given supply from one institution or branch storehouse, if he has not the article in stock, may call upon some other institution or branch storehouse to furnish it. It frequently happens that one storehouse is in urgent need of an article, which has been collecting dust on the shelves of another institution for years. Such a condition is an inexcusable waste, by necessitating the purchase of that article for the institution in need instead of its being supplied by the institution which has the surplus.

Consumption—The consumption of supplies in city institutions is generally in a chaotic condition, because accurate and complete statistics are not kept of quantities, reasons and results. By the proper records an accurate quantity of every article of supplies should be established for every purpose. Such a method has been undertaken to considerable extent thruout public institutions of the country in relation to food supplies, but the same method can be made to apply to clothing, paints, lumber, hardware, coal, forage and other large items. Such regulations should be established on precisely the same system as are rations for an army, and while it requires time and labor to institute such a system, when it is once established, it will be much simpler to maintain and will insure economical current use.

IMPORTS OF CREOSOTE OIL

The war-time history of foreign creosote oils as sketched by G. A. Lembcke for the American Wood Preservers' Association shows that the situation has been relieved somewhat.

During the months immediately following upon the outbreak of the European war it looked as if all shipments of creosote oil from Europe were definntely and suddenly stopped. The British, as well as German governments, immediately placed an embargo on the exportation of creosote oil on the grounds that they needed it for their own purposes.

In Germany, the embargo still exists, while in Great Britain it was found that the fact that the British creosote oil solidifies unless kept at a temperature of about 90 degrees F. made its employment for the purposes originally intended impossible, and the embargo against exportation was consequently withdrawn. Even then, as the British Admiralty had commandeered for their own purposes practically all available tank steamers, the question of transportation from the United Kingdom to the United States offered serious difficulties.

As time went on, however, it was found that the tar distillers in Great Britain were called upon by the government to make deliveries of coal-tar products for the purpose of manufacturing war material. Incidental to supplying this demand, increased quantities of creosote oil were produced and subsequently accumulated in the available storage tanks of the distillers. Thus gradually a situation arose where the distillers' creosote storage needed relief in order to enable them to meet the government's demands for coal-tar products for ammunition manufacture. Confronted with this situation the British Admiralty finally consented to relieve the storage by releasing from time to time, as needed, tank steamers for the purpose of conveying from the accumulated stocks creosote oil from the United Kingdom to the United States. The result of this action was that during the second half of 1915 shipments to this country were made in larger volume than during the early part of the year.

While under present conditions, on account of the censorship and other precautionary regulations in Great Britain, it is more difficult to secure exact records and figures, from the information available and at hand it can be estimated that the shipments of creosote oil from the United Kingdom to this country during the year 1915 amounted to about 30,000,000 to 35,000,000 United States gallons. Compared with importations of foreign creosote oils during 1912 of approximately 60,000,000 United States gallons; during 1613 of approximately 55,000,000 United States gallons, and during 1914 of approximately 43,000,000 United States gallons, the above importations naturally show a considerable decrease.

It must be considered, however, that this year's total imports excludes all German and Belgian oils, and that the total volume of importations for 1915 consisted of British creosote oil only. Due to the fact that several of the large railroad systems on account of uncertainty of supplies, decided to abstain for the time being from the use of creosote oil, as well as to the depressed general conditions in this country, particularly during the early part of 1915, the importations during 1915 sufficed to meet in a measure the somewhat decreased demand.

How the position is going to shape itself during the year 1916, or even beyond that, of course, remains to be seen and is largely dependent on the duration of the war. If the war should be protracted for another year German and Belgian supplies will not be available for importation. The loss, however, will in all probability be slightly offset by an increased quantity of creosote oil available for shipment in the United Kingdom where as a result of the increased demand for coal-tar products a good many byproduct ovens have replaced the old beehive ovens. It must, however, not be assumed that such possible increase in the production of Great Britain be sufficiently large to totally offset the loss caused by the falling off in Continental quantities.

The law of supply and demand suggests that prices for foreign creosote oil in this country will remain about on the present level as long as conditions are as just outlined. Even should the war end some time during 1916 it is not reasonable to suppose that a decided change in price will take place.

Stocks in Germany are entirely exhausted, and export of creosote oil after the war must of necessity at first at least be slow and reduced in volume. In Great Britain and the other countries involved in this war an immense amount of renewal work must be done after peace is declared, and, therefore, European consumption will be increased while the total output of creosote oil probably will assume ante bellum proportions.

Water Tower for High-Pressure System

OF BOSTON, MASS.

To supply pressure for some of the higher districts of Boston the small tower shown in the above cut has been in use for some years. Greater capacity being required now, the larger tower has been constructed of steel surrounded by a masonry wall for protection from cold and weather.

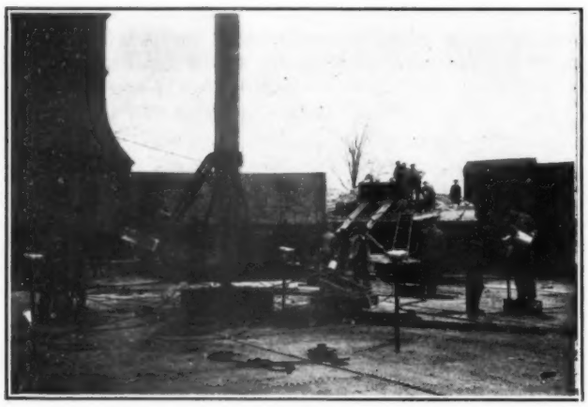
THE Metropolitan Water and Sewerage Commission, Boston, Mass., has had constructed a circular water tower on the summit of Mt. Bellevue, in the West Roxbury district. The elevation of the top of this hill is 340 feet, it being the highest point in the city. The reservoir provides extra high pressure service to the southern portion of the Metropolitan District, including West Roxbury and Hyde Park.

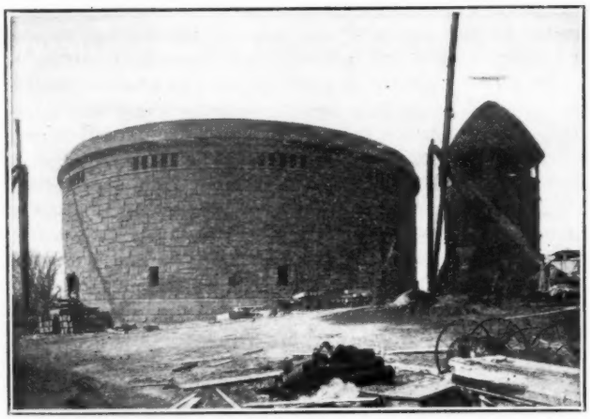
The tower, which has a capacity of 2,500,000 gallons, consists of a steel plate tank enclosed in granite masonry, with a roof. It is circular, 114 feet 2 inches in outside diameter. The tank is 44 feet high and 100 feet in diameter and rests on a concrete foundation and floor having a minimum thickness of 12 inches. There are seven courses of steel plates, the bottom course being 7/8 inch thick, diminishing to 3/8 inch at the top course. The plates are in 20-foot sections, 6 feet 4 inches wide, and are boiler riveted. The steel plate floor of the tank is supported on the concrete base, with mortar joints, poured thru holes in the floor, intervening.

The masonry walls are 47 feet in height and stand on concrete foundations, which extend 8 feet below the general ground level. The face of the wall is of squared stone masonry, with no projections or depressions of more than two inches from neat line of wall. No stones have less than a 6-inch rise nor 12-inch length of bed. Stretchers are at least 12 inches deep, and headers 20 inches.

The face of the base of the tower below the water table is coursed granite. The face of the water table, the voussoirs

GROUTING FOUNDATION *of steel bottom of tank. The process of pouring the grout into the various funnels shown is clearly seen. The foundation is thus made homogeneous, so that unequal strains are not put on the steel. The holes for the grouting pipes are afterwards carefully capped.*





THE OLD TOWER ON THE RIGHT, THE NEW TOWER ON THE LEFT.

of the arch at the front entrance, the bands above and below the upper windows, all window sills, the upper course of the cornice and the exposed surface of the parapet coping are rough pointed. Other trim surfaces are fine pointed. Rockport granite was used, being brought to Boston by schooner and hauled to the site. A wire cable operated on a drum by a portable engine also operating derricks, was used to assist the wagons up the steep incline. All stone except for trim was shaped on the ground.

Between the masonry and the tank is a concrete backing with a maximum thickness of 14 inches, and between this and the tank a space four feet wide. The concrete consists of a 1:2:4 mix, with Plum Island sand and broken stone. Mortar used for joints was one part cement to three parts sand. The specifications provided that no stone masonry be laid more than three feet in advance of the concrete backing, and that the walls be kept at a fairly uniform height around the circumference. Water-tight forms were used.

Steel work, pipes, anchor bolts, etc., are built into the concrete, a layer of mortar being placed next the materials and finer portions of the concrete deposited next the mortar.

Walks around the bottom of the steel tank, and concrete

CONCRETE FOUNDATION *for the masonry tower surrounding the steel tank seen in the background.*

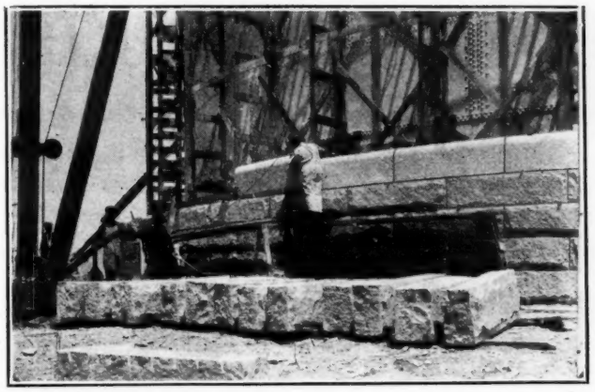
stairs leading up inside, have a one-inch granolithic surface of 1:1 mix.

A parapet 4 feet high above the cornice runs around the roof, which is pyramidal in form, with a central hexagonal roof. An observation tower is provided.

The steel roof trusses are supported on six steel columns, set 17 feet inside the wall of the tank. The turret roof is covered with Imperial German interlocking roof tiles, and the remainder of the roof is of reinforced concrete covered with a layer of reinforced Neufchatel asphalt. The turret walls are of Natco XXX 4x12-inches hollow terra cotta tiles laid in cement and plastered with cement on the outside face. The roof tiles, which are a full-glazed dull green, 16x9 inches, are laid with an 8x13⅜-inch exposure, directly upon steel angles, and fastened with copper clips.

Iron stairways lead from the front entrance up to the roof, and from the front entrance down to a granolithic wall constructed around the enclosed steel tank.

The total cost of the work was $71,271, divided as follows: Foundation and grading, $5,874; steel work, $19,397, and masonry, $46,000. The contractors for these three divisions were John E. Palmer, Boston; Walsh's Holyoke Steam Boiler Works, Holyoke, Mass., and John Cashman & Sons Co., Quincy, Mass. W. E. Foss is the Commission's acting Chief Engineer, in whose charge the tower was constructed.



LAYING COURSED ASHLAR *in the masonry wall surrounding the steel tank. Note space between masonry and steel.*

THE HIGHEST DAM IN THE WORLD

The Arrowrock Dam near Boise, Idaho, which has recently been put in service stores water for irrigating the Boise Project of the United States Reclamation Service in the neighborhood of such cities as Boise, Nampa and Caldwell. It is the highest dam in the world, having a height of 348.5 feet. It is 1,100 feet long on top, has a 16-foot roadway on its crest and contains 585,200 cubic yards of concrete. It has a gravity section and in plan shows a curve of 680-foot radius. The spillway is 400 feet long with a concrete-lined discharge trench approximately 900 feet in length with a capacity of 40,000 second-feet. In the spillway and trench lining are 25,400 cubic yards of reinforced concrete.

This spillway has a movable crest which may increase the storage of water six feet above the fixed crest, but drops automatically, very slowly, in case of flood, so as to give the full capacity of the spillway when needed. It rises automatically again when the flood has passed.

Logs floated down the river by lumbermen are hoisted to the top of the dam by a cable lift and taken to the river below thru a reinforced concrete chute 650 feet long, the upper 400 feet of which carries a bull chain with spurs or teeth set to hold against sliding, which carries the logs down a 62½ per cent slope and delivers them to a gravity chute thru which they pass to the river. It is estimated that there is three billion feet of timber in the Boise Basin above the dam that must be handled in this way.

A standard gage railroad, 17 miles long from the Oregon Short Line, was required and in four years has carried 80,000 passengers and about 14,000,000 ton-miles of freight. It is the only railroad in the country operated by the Federal Government and all tickets carry the signature of President Woodrow Wilson in facsimile.

A 3,000 horse-power hydro-electric power plant was built to furnish power for the operation of the construction plant, whose plus output has been sold to local companies. A sawmill was operated for almost two years in the forest above, furnishing 6,750,000 feet of lumber for the building of the construction camp at Arrowrock, and supply timber for trams and miscellaneous requirements on the work.

The excavation for the dam extended 90 feet below the river bed to the granite foundation, and a diversion tunnel 500 feet long with a cross section 30x25 feet carried the river around the work until the construction was far enough advanced to start the storage of water.

Regulating outlets in the dam are 20 in number each being 4 ft. 4 in. in diameter, and controlled by a 58-inch balanced needle valve on the upstream face of the dam. They are arranged in two sets of 10 each, the upper set being 150 feet above the river bed. Five sluicing outlets, each controlled by a 5x5-ft. sliding gate, are also provided at river level. All these outlets are operated from control chambers inside the dam.

A system of inspection galleries of which the control chambers are a part give access to the dam at several elevations, the lowest of which is 230 feet below normal high water surface in the reservoir. The capacity of the reservoir is 244,300 acre-feet, or about 79,600,000,000 gallons. The reservoir is 18 miles long and extends up two forks of the river. When needed for irrigation the water is carried down 12 miles in the channel of the river to a low diversion dam and from there taken out over the land thru a network of canals and laterals. In this way 234,000 acres of sagebrush desert is to be converted into gardens, orchards and farms.

The principal quantities involved in the construction of Arrowrock dam and the spillways are as follows: Excavation, 682,000 cubic yards; concrete, 610,600 cubic yards; reinforcing steel, 1,350,000 pounds; gates and structural steel, 1,800 tons.

BOOKS ON PURIFICATION OF WATER

Many readers having asked for a revision and extension of the classified descriptive lists of books on municipal engineering subjects which were printed in MUNICIPAL ENGINEERING *some years ago, this list of books on water purification has been prepared as the first of a series of lists which will follow at intervals as they may be asked for. Any desired books will be included in these lists on request and if any have been omitted the omissions will be supplied on notification. The list has been confined almost wholly to books in the editor's library.*

BOOKS treating of the purification of water may be divided into four general classes: (1) Those which treat generally of the desirability or necessity of water purification and give more or less idea of the methods in use; (2) those describing methods of purification in use; (3) those giving methods of examination and analysis to determine the necessity of purification and amount required, and to determine the results of purification processes; (4) books on water supply which devote one or more chapters to the subject of water purification.

(1.) In the first class the following books are at hand:

Water Supply, Chemical and Sanitary, by William R. Nichols, was the earliest book on the subject and is still one of the best, but is now out of print.

Clean Water and How to Get It, by Allen Hazen, gives a good general view of the methods of obtaining good water from selection of a good supply to purification of one not so good, and an excellent comparison of various methods of purifying water. Cloth, 196 pp., $1.50. John Wiley & Sons, New York.

The Purification of Public Water Supplies, by John W. Hill, C. E., begins with a study of typhoid fever statistics and typhoid and other bacilli and continues with descriptions of processes of filtration, filter plants in operation and proposed, with figures of cost and a discussion of the legal liability for damage from sewage polluted water, which is perhaps somewhat extreme in some of its views in the light of present practice. A new edition brings it up to date. Cloth, 304 pp., $3. D. Van Nostrand Co., New York.

Water Supply Considered Principally from a Sanitary Standpoint, by Prof. W. P. Mason, is one of the earliest books on the necessity for water purification which has been kept up to date by new, rewritten editions from time to time. Cloth, 167 pp., $1.25. John Wiley & Sons, New York.

The Value of Pure Water, by Geo. C. Whipple. Cloth, 407 pp., $3. John Wiley & Sons, New York.

Municipal Chemistry, edited by Charles Baskerville, has two or three chapters on purity and purification of water. Cloth, 526 pp., $5. McGraw-Hill Book Co., New York.

Water Supply, an English students hand-book on the conditions governing the selection of service and the distribution of water, by R. E. Middleton. Cloth, 178 pp., $3. J. B. Lippincott & Co., Philadelphia, Pa.

Water and Its Purification, by Samuel Rideal, is an English book covering much the same ground as Hazen's, mentioned above, somewhat more in detail and applying more particularly to English conditions, but an excellent book for use anywhere. Cloth, 346 pp., $3. J. B. Lippincott & Co., Philadelphia, Pa.

2. In the second class are the following:

Filtration of Public Water Supplies, by Allen Hazen, was among the first books giving full detail of practice in treatment of water and in its latest edition is one of the best. It goes into detail of construction, operation and results of continuous, intermittent, mechanical and other filters, coagulation and other chemical treatments, cleaning filters, etc. Cloth, 321 pp., $3. John Wiley & Sons, New York.

Water Filtration Works, by James H. Fuertes, is a book on the design of water purification plants, including intakes, settling basins, slow sand filtration beds, rapid sand filtration apparatus, both gravity and pressure, small individual filters and filtered water reservoirs. Cloth, 283 pp., $3.50. John Wiley & Sons. May be out of print.

Water Purification Plants and Their Operation, by Milton F. Stein, assistant engineer of design on Cleveland filtration plant, is a manual for operation of water purification plants and the latest book on the subject. It is devoted principally to slow sand filtration plants and the larger installations of mechanical filters. It goes into detail on methods of operation of the plants, and gives full instructions for making physical, chemical and bacterial tests, and the interpretations of the results. It also describes the theory and practice of coagulation, sterilization with hypochlorites, chlorine, etc., water softening and sedimentation and gives the detail of the operation of the filters, records, statistics, cost, etc. For the class of filters covered it is the most practical book which has appeared. Cloth, 247 pp., $2.50. John Wiley & Sons, New York.

Water Purification and Sewage Disposal, by Dr. J. Tillmans, is a German book translated by Hugh S. Taylor, about half of which gives a clear but brief statement of filtration and sterilization of water for domestic purposes, and purification for industrial uses. Much is included in very brief compass. Cloth, 143 pp., $2. D. Van Nostrand Co., New York.

Purification of Sewage and Water, by W. J. Dibdin, is an English book, about 75 pages of which is on the subject of sand filtration of water. Cloth, 380 pp., $6.50. D. Van Nostrand Company, New York.

Water and Sewage Purification in Ohio; is a report of the State Board of Health, made in 1908, which gives descriptions of plants in operation in the state and statements of results of operation.

Water Purification at Louisville, Ky., by George W. Fuller; is a report of the experiments on water filtration made by that city in 1895 to 1898 and of the conclusions reached. Cloth, 460 large pages with numerous diagrams, $10. D. Van Nostrand Co., New York.

Other books listed in catalogs are Wehrenfenning & Patterson's "Analysis and Softening of Boiler Feed-Water," 290 pp., $4; Rector's "Underground Waters for Commercial Purposes," 97 pp., $1.

3. In the third class are the following:

Examination of Water, chemical and bacteriological, by Professor William P. Mason, is quite full upon the chemical examination of water, and rather brief as to bacterial methods, as such methods were not very fully developed at the date of issue. Cloth, 135 pp., $1.25. John Wiley & Sons, New York.

The Microscopical Examination of Potable Water, by Geo. W. Rafter, gives the technique of examinations of plankton and tables of results of the same. Boards, 160 pp., 50 cents. D. Van Nostrand Co., New York.

The Microscopy of Drinking Water, by George C. Whipple, gives not only methods of analysis, but a full description of the organisms found, their geographical, seasonal, horizontal and vertical distribution, the odors and tastes produced, the consequences of storage of surface and ground waters, growth of organisms in water pipes, and a detailed classification and description of the species of plant and animal life under discussion. Cloth, 300 pp. and many plates, $3.50. John Wiley & Sons, New York.

Elements of Water Bacteriology, with special reference to sanitary water analysis, by S. C. Prescott and C. E. A. Winslow, is a full discussion particularly of bacillus coli communis and accompanying forms, methods of isolating and counting, and interpretation of results and is an excellent text-book on this subject. Cloth, 318 pp., $1.75. John Wiley & Sons, New York.

Water Analysis for sanitary and technical purposes, by Herbert B. Stocks, is an English hand book of the chemical examination of water with formulae for reagents and descriptions of the various processes. Cloth, 136 pp., $1.50. J. B. Lippincott Co., Philadelphia, Pa.

Chloride of Lime in Sanitation, by Albert H. Hooker, has one chapter on its use for water purification. Cloth, 230 pp., $3. John Wiley & Sons, New York.

Laboratory Notes on Industrial Water Analysis, by Ellen H. Richards. Cloth, 56 pp., 50 cents. John Wiley & Sons, New York.

Air, Water and Food from a sanitary standpoint, by Ellen H. Richards and A. G. Woodman. Cloth, 278 pp., $2. John Wiley & Sons, New York.

4. In the fourth class the following may be mentioned among those published:

Public Water Supplies, requirements, resources, and the construction of works, by F. E. Turneaure and H. L. Russell. This complete discussion of water supply problems devotes about 200 pages to the quality of water supplies and works for the purification of water, including sedimentation with and without coagulation, slow and rapid sand filtration and other forms of purification, including softening and the use of chemicals, giving a very satisfactory amount of detail as to design and results. Cloth, 808 pp., $5. John Wiley & Sons, New York.

Water-Supply Engineering, by A. Prescott Folwell, devotes a few pages to an excellent brief description of modern methods of water purification. Cloth, 570 pp., $3.50. John Wiley & Sons, New York.

Elements of Sanitary Engineering, by Mansfield Merriman, has a chapter on water and its purification and descriptions of plants in appendices. Cloth, 250 pp., $2. John Wiley & Sons, New York.

Water Works for Small Cities and Towns, by John Goodell, has a brief 14-page chapter on filtration plants for such works, showing the limitations for such service. Cloth, 286 pp., $2. McGraw-Hill Book Co., New York.

Sanitary Engineering with respect to water supply and sewage disposal, by L. F. Vernon-Harcourt, is an English book with a good 40-page chapter on purification of water by sedimentation, filtration, aeration, and softening, with examples from English and colonial practice. Cloth, 419 pp., $4.50. Longmans, Green & Co., New York.

Water and Water Supplies, by Dr. John C. Thresh, is an English book of 527 pp., 300 of which are on the purity of water and how to secure it. The discusion is more from the sanitary point of view and less from those of design and construction than most of the others mentioned. $2. P. Blakiston's Son & Co., Philadelphia, Pa.

Water Supplies, their purification, filtration, and sterilization, by Samuel Rideal and E. K. Rideal, is a book by one of the foremost English experts in water and sewage purification which goes into detail in all the lines mentioned in its sub-title. As it is but a year old it is quite up to date, and gives greater detail about the application of the most recent improvements in methods of purification and especially sterilization, than any of the books in this list except, possibly, Stein's. Cloth, 274 pp. D. Appleton & Co., New York.

Books reported in press by Van Nostrand's latest catalog, which give attention to water purification, are Corey's "Water-Supply Engineering" and Hill's "Interpretation of Water Analysis."

THE CITY MANAGER PLAN FAVORED

The committee of the National Municipal League on municipal program heartily approves the commission-city management plan as the ideal way in which to run a city.

The committee has recommended that the city manager shall be the chief executive officer of the city, that he shall be chosen by the council or commission solely on the basis of his executive and administrative qualifications, and the choice is not limited to inhabitants of the city or State. The committee suggests that he shall be appointed for an indefinite period and removal by the council, but if removed after six months he may demand written charges and a public hearing before the council prior to the date on which his final removal shall take effect.

The city manager under the plan is made responsible to the council for the proper administration of all affairs of the city and to that end shall make all appointments, subject, of course to proper civil service provisions which are made a part of the model charter. Except when the council is considering his removal, the city manager is entitled to be present at all the meetings of the council and its committees and to take part in their discussion.

A council elected at large is provided for cities of average size, but in cities of more than 100,000 population, the city should, in the opinion of the committee, be divided into large districts, the size of which should never exceed 50,000 except in cities over a million. The purpose of this limitation is to keep the size of the district down to such a point that genuinely free competition for public office will prevail, the expense of a thoro canvass being not too great for an independent candidate who may lack the support of a permanent political machine.

The model charter contains up-to-date civil service, financial franchise provisions, as well as other necessary features of a charter.

The committee consists of William D. Foulke, of Richmond, Ind., chairman; M. N. Baker, of the Engineering News; Richard S. Childs, New York City; John A. Fairlie, University of Illinois; Mayo Fesler, Cleveland; A. R. Hatton, Western Reserve University, Cleveland; Herman G. James, Austin, Texas; President A. Lawrence Lowell, of Harvard; William B. Munroe, Harvard; Robert Treat Paine, Boston; Delos F. Wilcox, New York City, and Clinton Rogers Woodruff, Philadelphia.

QUESTION DEPARTMENT

Builders of Incinerators

We have a contract with this city that binds us to have a twenty-ton incinerator plant in operation here within six months.

We are informed that you probably could be of assistance in giving us the address of some firms who make a specialty of this sort of thing.

A., ———, Ill.

A lsit of builders of garbage disposal plants will be found in MUNICIPAL ENGINEERING, vol. xlvi, p. 381, and reference may also be made to the Business Directory published in each number of MUNICIPAL ENGINEERING, under the heading Garbage Disposal Plants.

Swimming Pools and Supplies for Them

Can you direct us where we can get information concerning the erection and cost of operating public swimming pools and where me can get supplies for them?

C., ———, Kan.

Several brief articles in MUNICIPAL ENGINEERING give descriptions of swimming pools, from a small street pool, serving also as a sewer flush tank, to the elaborate bath houses of New York and other large cities and the bathing beaches on artificial and natural lakes in or near inland cities.

The enclosed swimming pool at Rochester, N. Y., is illustrated on pp. 21 and 24 of vol. xxxix.

The open air swimming pool in Fuller Park, Chicago, is shown in vol. xliii, p. 401, the article giving also dimensions and equipment of various pools in the city and the methods of waterproofing them are described.

The cost of a pool in St. Louis, Mo., and the cost of operation, total and per capita, are given in vol. xlvi, p. 107, and vol. xlvii, p. 128, and a photograph of it in use will be found in vol. xlviii, p. 354.

A large pool in McKeesport, Pa., is illustrated in vol. xlvii, p. 127.

Denver, Col., pools are described and illustrated in vol. xlvii, pp. 128 and 313; vol. xlvii, p. 451, and vol. xlviii, p. 197.

One of the three outdoor pools in Toledo, O., is illustrated in vol. xlviii, p. 291.

A unique outdoor pool which serves in emptying as a sewer flush tank is shown in vol. xlix, p. 212. It is at Oakdale, Cal.

An elaborate bathhouse for all year round use, with bathing facilities as well as swimming pool, and a gymnasium in Chelsea Park, New York City, is illustrated in vol. xlviii. There are many of similar nature in the largest cities.

Oklahoma City, Okla., Boston, New York, Chicago, have pools open the year round.

Many other cities, such as Cincinnati, Milwaukee, Indianapolis, Kansas City, Cleveland, have pools and bathing beaches which are not inclosed and can be used only in the summer season.

A general article on the value of public baths will be found in vol. xlvii, p. 403. A method of purifying water from swimming pools so that it can be used again and again, thus saving water bills in a city, and heating bills in the winter, is described in vol. xliii, p. 159.

The A. G. Spalding Co., Chicopee Falls, Mass., and New York City, supply anything needed in the operation of swimming pools and bath houses.

Preventing Growth of Algae in Water

What is the experience in combatting algae growths in water where the object is not potability but freedom from vegetable growth which clogs up screens? We have a steam power plant recently started in the South using a maximum of 20,000 gallons a minute of condensing water, where the algae grow so luxuriantly that they give us trouble in the screens of our intake.

S., ———, Pa.

Revolving screens, some automatic in their action, have been used in sewage purification work in Germany with success and would doubtless be applicable in such a case as this. The Uhlfelder revolving screen has five radial screens which rotate uniformly against the current of water, removing the coarser material and lifting it out of the water, when an automatic brush forces it outward onto a platform which in turn is tipped up by the motion of the screens and emptied on a traveling platform which carries it away. The Riensch-Wurl screen recently introduced into this country by the Sanitation Company of Philadelphia may also be applicable if its operation is not too expensive. Probably either of these automatic screens would operate at less expense under the conditions described in the question than a bar or fine screen cleaned by hand, even tho the algae require attention for only a comparatively short part of the year. A brief description of the Uhlfelder screen will be found in Tillman's and Taylor's "Water Purification and Sewage Disposal" ($2).

Algae can be destroyed in their early stages of growth by the application of chemicals and thus the nuisance occasioned by their growth can be prevented. They can even be destroyed if the water is not treated until their growth is well along by increasing the dose and repeating it within a few days. But this would only partially remove the difficulty complained of. Two or more light treatments, the first early in the season and the others at intervals as experience may dictate will be much more satisfactory.

Sulphate of copper is one of the chemicals so used. It has been applied at rates ranging from 0.02 parts per million three times a week to one part per million for one treatment and even at three parts per 1,000 where bacteria as well as algae were to be destroyed. The quantity of water in the reservoir can be computed and the corresponding amount of copper sulphate computed. It is put in a bag and towed

around the reservoir under water by means of a boat until it has all dissolved.

The action of the copper sulphate may increase the amount of carbon di-oxide in the water and some chemical treatment of the water at the outlet to remove this acidity may be desirable if the condenser tubes are acted upon materially by the acid water. The number of bacteria, of harmless varieties probably, may be increased by the change in conditions due to the removal of the algae. An amount of say one part of copper sulphate per 2,000,000 parts of water will probably destroy the small animal and vegetable growths in the water and will be a good proportion to start with. The higher proportions will destroy larger animal life, even fish and frogs. Variations from this amount and frequency of treatment must be determined by experience. Various reports of methods of treatment will be found in Rideal's "Water Supplies" (Lippincott) and in the proceeding of the American Water Works Association for 1907, in a paper by T. W. Davey on stripping reservoir land, and in 1906 by James M. Caird, the latter going into much detail as to methods, apparatus and results and costs of various quantities.

Creosote has also been used for preventing growths of algae when applied at the right time, as noted in the same proceedings for 1910, in a paper by W. F. Wilcox.

Liquid chlorine has been used at Wilmington, Del., for the same purpose as described by S. M. Hoopes in the same proceedings for 1913.

Paving of Street Railway Area

We are having considerable trouble with some bitulithic street railway track pavement. The conditions are these:

The rails are standard 56-pound on wood ties spaced 2 feet o. c.; concrete under and about the ties. The top of the concrete extends slightly above the ties. The plans called for a 3-inch surface mixture between the rails of the track, wooden nose blocks being specified for next the rail. The work was built by laying a binder course of bitulithic, on which was laid the wearing surface, about 3 inches thick. The nose blocks were used as specified; also wood blocks were laid just outside the rail.

No provision is made for draining the track. The track pavement is laid in a continuous sheet for a distance of about 2,000 feet.

We find that, within six weeks after the work was completed, the pavement inside and next to the rails began to rise, the upward pressure or force splitting the nose block and carrying half of the block with the raised pavement. The 3-inch surface only is rising, the raised portion extending a foot or 18 inches from the rail. In a few places the pavement is rising slightly outside the rails. The trouble between the rails is so acute that the traction company was forced to pick off some of the surface in order that the cars might pass along the track.

Has such a condition as I describe come to your attention before? Are you able to suggest the probable cause of the trouble and any means for remedying it? This is our first experience with a soft pavement between the rails and we are wondering if such construction is really good practice. Any information or suggestions offered in this connection will be greatly appreciated. E., ———, Mont.

The cause of the trouble is probably due to the fact that a light rail is used. Experience has demonstrated that there must be considerable vibration of the rail where the rail is used as light as 56 pounds per yard and laid with ties on 2-foot centers. This is especially so considering the heavy rolling stock that is now used in most of our cities. Any pavement laid against a 56-pound rail will give trouble where the street car rolling stock is heavy, and this will be so, even if wood or stone headers are used on each side of each rail. The extent of the trouble, which will be due to this vibration, of course depends largely on the sub-foundation.

The remedy for your trouble is to require a heavier rail to be used. If it is impracticable to require a heavier rail construction, then some form of block pavement will be preferable between the rails and for 2 feet outside thereof, thus providing for a minimum expense in replacing the pavement where it is pushed up or heaved.

Collection of Waste Paper

This city is annoyed by the waste paper nuisance. We have been taking the waste paper along with the ashes and other rubbish. Our ordinance requires that all waste paper shall be tied in bundles, but it is practically impossible to get the householder to comply, consequently, when the ashes and rubbish are set out along the curb for removal the waste paper blows all over the streets, and it is put out in such quantities that it amounts to 30 or 40 per cent. of the contents of the wagons, thus costing the city a considerable amount of money, both for its removal and the cleaning of the streets. Have you any information as to the methods of collecting said refuse by other cities, and if there are any which do not remove the paper, requiring the householder to make other arrangements for its disposal?
P., Street Commissioner.

Probably the most complete records regarding garbage and refuse collection and disposal are those in the special report of the Bureau of the Census, giving General Statistics of Cities for 1909, which has special reports on sewers, refuse, street cleaning and highways. From that report it is learned that five cities collect waste paper separately, other rubbish being collected with ashes. These cities are Cleveland, Newark, Louisville, Hartford and Holyoke. All others making the collection include waste paper with rubbish. Twenty-one of them include rubbish with ashes and about eight include rubbish with garbage, a few including ashes also with garbage.

The rubbish contractors in Indianapolis tried to induce a separation of paper so that they could get the advantage of the price at which it could be sold, and refused to make certain collections if they were mixed. A supplemental contract was made covering all classes of refuse, which are now separated practically into garbage, combustible refuse, and incombustible refuse, and all refuse when so separated must be taken by the respective wagons, and paper is collected with other refuse.

There seems to be no method of forcing separations by householders except by refusals to collect unless separations are made and then holding the householders responsible for the private removal of their refuse, and any nuisance produced by its presence, including the scattering of papers.

Correspondence with the cities mentioned may secure information regarding their success with the separation of paper from other wastes. Cleveland, Louisville and Holyoke collected with city forces, Newark and Hartford by contract, at date of report.

Can our readers give any further information on this point?

Clay Treatment of Sewage and Industrial Waste

Can you direct us where to get information on the "Clay treatment of sewage and industrial waste," developed by Professor Rohland, of Germany? If you have any data on the above, kindly let us know how and where we can obtain same, and very much obliged.
S. C., Paterson, N. J.

Can our readers give any information about the process mentioned? The writer is not familiar with it. Clay has been used for sewage precipitation for some thirty-five years, the A B C process being one of the earliest processes employed, the letters standing for alum, blood and clay, but the alum and clay being the materials commonly used. The fine particles of clay attract the lighter particles of organic matter and the sulphate of alumina or other coagulant increases the action of sedimentation.

WORKERS IN THE FIELD

Asphalt Top for Old Brick Pavements

The Editor of MUNICIPAL ENGINEERING:

Sir—Many cities have old brick streets that are in poor condition after many years' wear. But while the old brick is useless as a pavement, it has a high value as a foundation. It is the worst kind of waste to tear up and throw away the old brick instead of making it serve as the support for a new wearing surface. For by using the old brick as a foundation a new pavement can be obtained for a fraction of the cost of new construction from the ground up.

A number of Ohio cities had a lot of old-fashioned brick pavements, full of holes and depressions, and with the brick so badly worn on the edges that the pavements almost presented the appearance of a corduroy road. It was impossible to clean these pavements and to ride over them was a bone-racking experience.

The situation was met by resurfacing these old brick streets with sheet asphalt and asphaltic concrete, and the result after several years' wear is to show that construction of this kind, rightly done, provides a pavement as durable as those placed on a new concrete base.

T. H. Brennan, of the office of the chief engineer of the Columbus department of public service, has made the following report:

"Concerning resurfaced streets, I beg to give you the following information:

Streets	Sq. Yds.	When Laid
Gay street	7,218	1912
Fifth street	2,577	1912
Sixth street	3,979	1912
Monroe avenue	3,300	1913
Wilson avenue	5,037	1914
Bryden road	9,850	1915

"All of the above streets are in first-class condition and there has not been any money expended for maintenance so far.

"Bryden road, from Parsons avenue to Ohio avenue, was resurfaced over old cobble stones with Trinidad asphalt in October, 1888. The cost of maintenance of this 12,573 square yards to January 1, 1915, has been one and seven-tenths of a cent per yard per year. The street is in good condition today and probably will be maintained at reasonable cost for several years longer."

Toledo likewise provides a number of examples of successful asphalt resurfacing over old brick. But one of the best examples is found in Youngstown, Ohio. The job in this instance is Wicks avenue, a business thorofare running thru the center of the city. In 1896, this street was resurfaced with but one inch of sheet asphalt, was down ten years, and was then called unsatisfactory and unsuccessful on account of the uneven surface permitting crowding. In 1906, this old one-inch coating was removed and relaid with an inch of binder and two inches of wearing surface. This, after eight years of service, is in excellent condition and not a cent has been expended for repairs, except where cuts were made for sewer or water connections.

Johnstown, Pa., has also met with complete success in resurfacing old brick pavements. Lexington, Ky., has had a similar experience. So have Cedar Rapids, Iowa; Peoria, Ill.; Indianapolis and other cities. In all these cases natural lake asphalt was used and the work was done by men who knew how to do it properly. The writer knows of but one case of failure of asphalt resurfacing over old brick. The failure was in Wheeling, W. Va., and is readily accounted for by the fact that a type of asphalt plant was employed which did not permit of turning out good mixture for any purpose, namely, a direct flame plant. Another factor was the use of a manufactured asphaltic compound which was a failure wherever employed and in the form then marketed was withdrawn from use.

As to the methods of resurfacing over old brick, the first essential in work of this character is that the old pavement shall be thoroly clean. Dirt must be not only swept from the surface but removed from the cracks. This can be done with wire brooms. However it is done, it must be done thoroly. Use of a fire hose will accomplish the removal of dirt even more effectively than sweeping, but if water is used the surface must be allowed to dry off thoroly.

Minor depressions in the old pavement may be brought up to a uniform contour by the use of binder (half-inch stone with about 4 per cent. asphalt cement), but no depressions of more than two inches should be filled in this way. These

RESURFACING WITH ASPHALT *an old brick pavement on Maryland street, Indianapolis. Note evening up of brick surface with concrete; also the grade pins set along the center line and at the quarters. Trinidad asphalt used.*

RESURFACING SIXTH STREET, *Columbus, O., with Trinidad sheet asphalt, using* 1½*-inch binder and* 1½*-inch top. Laid in* 1912 *over old brick street. Shows the steps in the process.*

latter should be cut out and filled from sub-base to surface with hydraulic concrete.

To secure perfect adhesion between the foundation and the asphaltic top, the brick or concrete should receive a paint coat composed of equal parts of commercial naphtha and asphaltic cement, applied at the rate of not more than one gallon per square yard of surface.

If a surface heater is available it will pay to warm up the street before the paint coat is applied. Dust or dampness prevents proper adhesion of the paint coat to the brick or concrete. Fill all depressions with concrete or binder as indicated, then clean and apply the paint coat.

As soon as the lighter parts of the paint coat have evaporated, and before it has had a chance to accumulate dust and dirt, the surface mixture should be placed and rolled. Either sheet asphalt with a binder course or asphaltic concrete may form the new wearing surface.

In cases where the curb is very low and for this reason it is undesirable to make the wearing surface two inches thick at the curb, it may be reduced from two inches at the crown of the street to a lesser thickness at the curb. In one case where very successful resurfacing of this description has been done, the asphalt top ranges from two inches at the crown to one inch at the curb, but so thin a wearing surface, even at the curb line, is not recommended as safe practice.

A new cement-grouted brick pavement is one thing. An old, rutted brick pavement with rounded edges on every brick, depressions and holes here and there, and dirt-filled spaces between every row of brick, is an abomination. But cities might be compelled to endure them if the way had not been pointed out to cover these old pavements with an asphalt wearing surface at small cost—very small indeed, considering that the city will get what is virtually a brand new pavement for the cost of a two-inch top.

D. T. Pierce,
Philadelphia, Pa.

Some Conclusions From Observation of Portland Cement in Storage

The Editor of Municipal Engineering:

Sir—These conclusions are not chronicled in the order of their importance. The one of the greatest importance is that water-tight storage is not sufficient, as practically air-tight storage is necessary to insure the cement against injury.

First: The strength of cement stored in bulk is maintained for a longer period than when stored in any other form. When I say stored in bulk, I mean in bins and not in piles on the floor. This period can be made practically indefinite if the circulation of the air over the top of the cement is prevented.

Second: The strength of cement stored in paper is maintained for a longer period than when stored in cloth.

Third: The closeness of the piling and the tightness of the floor are essentials to the successful storing of cement. In piling cement for storage the arrangement of the piles or ricks should be such as to present the least number of square feet of ends, sides and top of the piles. Care should be taken in piling cement that there are no available air spaces between the bags.

Fourth: A tarred cloth cover over the top, sides and ends of the piles will, to a very large extent, prevent the caking of the cement.

Fifth: There is a saying, "If you would prevent your cement from caking, turn the sacks every month." My observation is that this is a fallacy. Turning the cement merely breaks the very thin cake formed in a month into small particles that feel thru the sack like cement and sand mixed. Turning cement is really a detriment, as it breaks up the thin and partially water-proof cake and presents a fresh supply of cement to be spoiled by contact with the sack. Turning the cement may fool the inspector.

Sixth: Dry storage alone is not enough, it must be air-tight to prevent the caking. The tightness of the floor is not given the consideration that it should have, as it presents means for the circulation of moisture-laden air and at the same time permits the leakage of considerable cement. In fact, the tightness of the floor is almost as important as the roof. We have all noticed the sweating of an ice water pitcher in the summer time. The air which closely surrounds the pitcher is cooled until the dew point is reached.

Two factors which control the moisture-carrying capacity of air are the temperature and the pressure. Any increase in either will increase the capacity of air to carry moisture.

The point that I am trying to make here is that moisture can reach cement in other ways than a hole in the roof or a crack in the side of the building. During a cold snap the cement will very nearly reach the average temperature of the storehouse and, as frequently occurs, the next change brings moisture-laden atmosphere and a falling barometer. The air having free circulation into the storehouse and the piles of relatively cold cement lowers the temperature of the air actually in contact with the cement to the dew point. This gives the cement a coating of moisture. The air being cooled falls by gravity, thus affording a continuous supply of moisture-laden air. This will continue until the temperature of the cement has risen to that of the surrounding air.

Seventh: If cement is to be kept in exposed piles and in perfect condition the temperature of the room must be maintained at a temperature considerably higher than the outside air.

Eighth: Cloth cement sacks are badly injured by the above mentioned deposit of moisture by the air, as the chemical action set up tends to destroy the fibers of cotton of which the sacks are made.

Ninth: An ordinary canvas cover is better than no cover at all, but a tarred canvas cover is practically air tight.

Ten gallons of coal tar, two gallons of good japan dryer and two gallons of gasoline will make a black paint for coating canvas covers, making them water tight.

Covers made of as light as unbleached muslin coated with a good flexible paint are effective in protecting cement from the air.

S. P. Baird, M. Am. Soc. C. E.,
Columbus, O.

LEGAL DECISIONS

Is the Bid Legal?

On January 21, the city council of Iowa City, Iowa, awarded to William Horrabin the contract to construct the new bridge over the Iowa river, at the foot of Iowa avenue, for $77,400. His bid read that he would build the structure for $500 lower than the lowest bidder, and the Widell Company, of Mankato, Minn., was the lowest bidder at $77,900.

The award of the contract is attacked on the ground that it is illegal, this form of bid not being valid as being too indefinite and not regularly conforming with the requirements of the advertisement and specifications.

Mr. Horrabin, however, seems to be so confident of his position that he says he is willing to take the contract for the bridge and build it under a provision that if the decision in the suit is against him the city shall not be in any way indebted to him for the work.

Other bids were from $86,000 to $89,000.

The Conditions of Recovery for Pollution of Stream

A city constructing a sewer emptying into a stream above the land of a riparian owner does not thereby commit a trespass on the land, tho the flow of sewage with the waters of the stream may invade a substantial right of the owner.

A city maintaining for more than ten years a sewer emptying into a stream does not acquire by prescription a right to maintain a nuisance on the land of a lower riparian proprietor, where the use of the stream was permissive and not under any claim of right.

A city, to establish a prescriptive right to maintain a nuisance by maintaining a sewer emptying into a stream to the injury of a lower riparian proprietor, must show that the user has continued in substantially the same way and with equally injurious results for the statutory period.

A purchaser of land on a stream below the place where a sewer erected by a city emptied into the stream may recover damages sustained, since his purchase, by the pollution of the stream and the air, where at the time of the purchase the fact of the sewage was hardly perceptible, and where the vendor had not recovered damages and the city had not obtained the right to maintain the sewer.—Ansler et al. v. City of Sedalia (Mo.), 176 S. W. 1102.

Decisions of the Higher Courts of Interest to Municipalities

Injunction Against Portable Asphalt Plant Nuisance Not Wanted.—In an action for damages and injunction it appeared that defendant, under contract with the city to pave the street with asphalt in such a manner as to require a high degree of heat, located his plant at a point 175 feet from plaintiff's dwelling. Upon the hearing the judge below found that the operation of the plant caused gritty dust to be thrown into plaintiff's house when the wind was from the south, causing great damage to the furniture; that this dust and the smoke was a menace to the health of plaintiff and her boarders, whereby the latter were threatening to leave, thus seriously affecting her means of livelihood, and that the dust and smoke had produced soreness of one of plaintiff's eyes, which threatened to become chronic. The court also found that defendants were able to respond in damages, that the machine was in the most fitting location to accomplish the work, and that to stop the work would greatly interfere with the public good. *Held*, That the court below properly refused to grant an injunction until final hearing, since, in cases where important public works are sought to be stopped, courts will await a finding of facts by a jury before interfering by injunction.—Jones v. Lassiter et al, (N. C.) 86 S. E. 710.

Water Company Must Supply Automatic Sprinklers without Meter.—A municipal ordinance passed in 1871 authorized a water company to operate a system of water works to supply the city and inhabitants with water and for that purpose to lay pipes in the streets and to charge a sum fixed by a schedule of rates to be established by agreement between it and the city, or by arbitration. Under such ordinance a schedule of rates was established as prescribed, which established that distilleries, foundries, machine shops, locomotives, soap or starch works, and manufactories of all kinds, should be charged at meter rates for the estimated quantity of water used (where meters were not used). A paper mill installed an automatic sprinkler system, a new device for fire protection, and upon its refusal to install meters at its own expense to measure the amount of water used, and to pay $300 in addition to meter rates, the water company threatened to cut off its supply. The mill sued to enjoin such action, claiming that the water company, under the ordinance and schedule, was obligated to furnish water at meter rates, the quantity being estimated, without the installation of meters, which it was alleged would impair the efficiency of the fire protection. *Held*, That the water company was obligated to furnish the mill water at meter rates without the installation of meters, the quantity used being estimated.—Terre Haute Paper Co. v. Terre Haute Water Works Co., (Ind.) 110 N. E. 85.

Conveyance of Abutting Front of Lot Does Not Relieve Remainder of Lot of Sewer Assessment.—The owner of a lot, on which is his residence, by conveying, in anticipation of a street improvement, the front eight feet, reserving the use of it as a means of ingress and egress, with provision that no fence or sidewalk shall be constructed thereon, cannot exempt from assessment the part retained as non-abutting on the street.—Bayes v. Town of Paintsville, (Ky.) 179 S. W. 623.

Water Company Cannot Condemn Property to Sell Water Outside Its Own Municipality.—The Water Company Act of

1876 (3 Comp. St. 1910, p. 3635), Sec. 1, provides that any number of persons not less than seven may form a company to construct and operate water works in any city, town, etc., to supply such city, town, etc., with water. Section 3 provides that any company incorporated thereunder may take and divert springs and streams of water necessary for the purposes of its incorporation. Section 5 provided that, if it cannot agree with the owners of any lands from which it may desire to divert any springs or streams as to compensation, condemnation proceedings may be resorted to. *Held*, That such a company may only exercise the power of eminent domain for the purpose of acquiring water and water rights reasonably necessary for the supplying of water to the municipality in which its works are located and the inhabitants thereof, and water required by it for the purpose of supplying other municipalities with which it has made contracts must be obtained by purchase from or agreement with those controlling such water.—Mayor and Aldermen of City of Paterson v. Montclair Water Co., (N. J.), 94 Atl. 889.

A water company organized to supply the township of W. and its inhabitants with water, which, under color of eminent domain proceedings, brought ostensibly to obtain water for such township, diverts from a stream water for the further purpose of supplying other municipalities with which it has made contracts, is guilty of a fraud on the state, and liable to make compensation for the injury resulting from its wrongdoing.—Mayor and Aldermen of City of Paterson v. West Orange Water Co., (N. J.) 94 Atl. 891.

City Liable for Damage from Its Electric Wire Wrongly Placed.—Where a wire connecting a house with the city's power line was so strung that a wire clothesline, when raised by a pole, as is customary, would come in contact with it, such wire connection with the power line was negligently defective, since due care requires that conductors of electricity be so placed with reference to similar conducting agencies that dangerous contacts are not probable.—Elias v. Mayor and Board of Trustees of City of New Iberia, (La.) 69 S. W. 141.

Who Pays for Defective Water Pipe Passed by Inspector.—Where iron pipe is sold, "subject to inspection," is inspected and accepted, and after being used in the construction of a water works system is found in part defective, and it is not shown that by a proper inspection such defects could not have been discovered before said pipe was used, there can be no recovery on the part of the purchaser, upon the ground that, notwithstanding said pipe was inspected and accepted, there was an implied warranty on the part of the seller that said pipe was adapted to the use for which it was bought.—Sherman v. Sheffield Cast Iron & Foundry Co., (Okla.) 159 Pac. 1062.

Jitney Bus Ordinances Valid.—A municipal ordinance, regulating jitney busses and requiring a permit and bond and the payment of a license fee, is not void in providing for a classification based upon the amount charged for transportation.

A provision in a city ordinance making it unlawful to operate a jitney bus unless the operator has thirty days' experience in operating an automobile in the city, is not an unreasonable exercise of the police power.

A municipal ordinance regulating jitney busses and providing that the owner or lessee must give a bond in the sum of $10,000 conditioned for the payment for all injuries from the negligent operation or defective construction of the jitney bus or from violation of statutory ordinances, or a policy of insurance insuring the owner or lessee against loss by reason of damage to person or property from the operation of the jitney bus, which policy shall aggregate $10,000, is not invalid, being within the scope of the power of the municipality.

A municipal ordinance requiring the owners or operators of a jitney bus to give a bond in a certain sum, conditioned upon payment of damages for injuries to person or property, is not invalid in requiring the bond to be that of a surety company.—Ex parte Cardinal, (Cal.) 150 Pac. 348.

An ordinance of a city regulating the operation of jitneys using streets for local transportation and requiring operators to give a bond for the protection of citizens, does not deny due process of law merely because it provides for a forfeiture for certain infractions of the ordinance.

A city having exclusive control of its streets, with power to grant franchises for their use, and to license trades and business, may prohibit the use of streets for the private business of one operating a jitney as a common carrier of passengers, or may give permission for such use and compel the payment of a license fee.

A city charter authorizing the granting of franchises for the use of streets for a public purpose, covers any franchise subject to thte limitation that it must be made in the interest of the public, and the authority conferred is not confined to granting franchises only to individuals and corporations granted a designated right of way.

Under a city charter authorizing the city to license trades and business, and charge license fees which shall not be construed as occupation taxes, a license fee, imposed for the use of streets for jitneys as carriers of passengers, is not an occupation tax.—Greene v. City of San Antonio et al., (Tex.) 178 S. W. 6.

Damage from Sewage in Stream.—Under Const., Art. 2, Sec. 22, providing that private property shall not be taken, appropriated or damaged for public use, without just compensation, a municipality or sewer improvement district, while entitled to obtain outlets outside the corporate limits, cannot take or damage property without just compensation, and in case they turn sewage into a stream, to the injury of lower riparian owners, the damages should be assessed on the theory of a permanent taking under a right of eminent domain.

That a sewer system and outlet were put in operation in 1910, and sewage discharged for three years thereafter in a stream on which plaintiff was a riparian proprietor, does not bar his action to enjoin the maintenance of the nuisance.

Where a sewer system was negligently maintained so that it constituted a nuisance, the nuisance will be enjoined.—Jones v. Sewer Improvement Dist. No. 3 of City of Rogers, (Ark.) 177 S. W. 888.

Water Company's Liability for Fire Loss.—A water company contracting to furnish water thru plaintiff's fire pipe line, which plaintiff was to keep in repair, in protection of its property in the water could refuse to perform its contract while the line was out of repair and wasting the water, and, if the loss occurred during such time, was not liable.

In an action to recover for the loss of property destroyed by fire, alleged to have resulted from the breach of defendant water company's contract to furnish water to plaintiff's fire pipe line, the measure of damages was the value of the property actually destroyed by the fire, and within the contemplation of the contract. In such case the amount of the insurance collected by the plaintiff was to be applied to the reduction of the damages pro tanto.—Warren Co. v. Hanson, (Ariz.) 150 Pac. 238.

Damages for Destruction of Shade Trees by Street Improvement.—At common law, where no compensation was allowed the abutting owner for authorized highway improvements, such as a change in grade, municipal authorities could destroy shade trees in the street without compensation. Under Village Law, authorizing an award of compensation to owners of realty affected by a change in grade of a street, damage to the land from the destruction of shade trees in the street may be recovered by the owner, since the purpose of the statute is to impose liability whenever the land adjacent to the street is injuriously affected. Goodrich v. Village of Otego (N. Y.), 110 N. E. 162.

FIRE DEPARTMENT

Motor Apparatus in Fire Departments

Superintendent of Public Safety, Mr. P. S. Harmon, city of Williamsport, Pa., submits the following statistics covering comparison of a horse-drawn and motor-driven chemical engine for period of December 1, 1913, to December 1, 1914:

"During the 365 days in which the records were kept the motor-driven apparatus responded to ninety-nine alarms. The engine responded to sixty-nine alarms and went into active service at only three.

"The cost of the fire engine and horses for upkeep aggregated $312.64 for the year. This cost is divided as follows: Feed and hay, $272.89; shoeing, $31.75; coal, 8, making an average cost of approximately 85 cents a day. The cost of maintenance for the motor chemical totaled $48.10, divided as follows: Gasoline, $25.20; oil, $9; repairs, $13.50, an average of about 13 cents a day."

NEW DOVER, N. J., COMBINATION.

A quite recent addition to the motor-driven apparatus operated by the fire department, city of Dover, N. J., consists of a self-starting, 6-cylinder, 60-h.p. White motor combination chemical and hose truck.

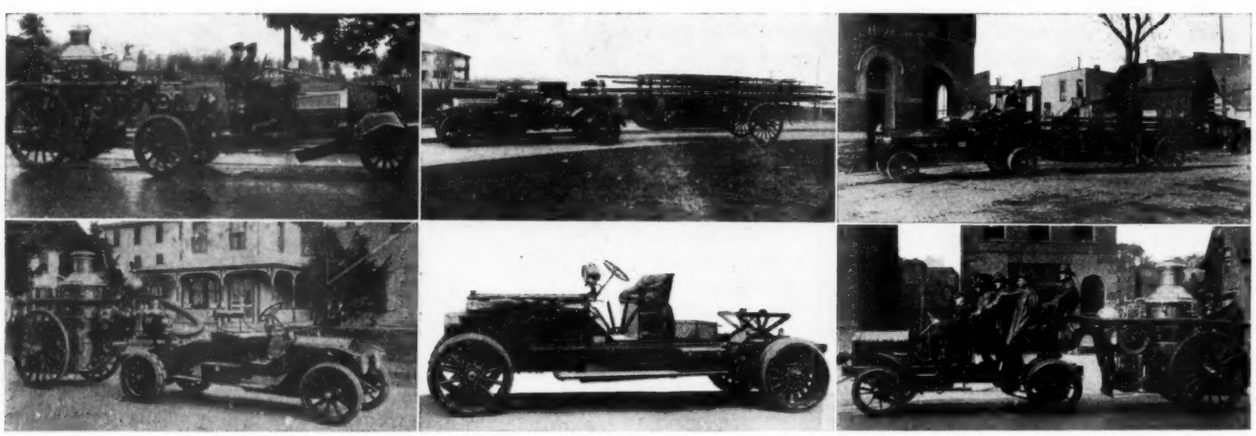
Twelve hundred feet of 2½-inch hose are carried in a steel hose bed which is quickly accessible from the rear running board. This bed occupies the conventional position between two seats running lengthwise of the machine. These seats, which are capable of seating eight firemen, have cushions that are deep and soft. Beneath each row of seats are large lockers. Hand chemical tanks are strapped to the running board and the large nozzles for the 2½-inch hose are carried on posts that are built on the rear running board. Hooks, lanterns, axes, etc., are carried on the spring catches and hooks along the side of the body. A 50-gallon chemical tank is mounted in the customary place in a recession between the driver's seat and the hose bed, while the chemical hose, 250 feet long, is coiled in a steel basket immediately above the chemical tank.

FUNCTIONS OF MOTOR GENERATOR.

The motor generator, mounted at forward left side of engine and driven by a silent chain, performs both starting and lighting functions. The entire control is centered in a single knife-blade switch located on the dash. When the driver has closed this switch the electric system assumes its duties and performs every function without any further attention and without the assistance of any automatic regulating devices.

Closing the switch connects the nine-cell battery and puts the motor in operation, thus starting the engine. As soon as the latter is turning over at a speed in excess of a few hundred revolutions per minute, the generator being a slow-speed type, the voltage of the motor generator exceeds that of the battery, and the battery is charged at all speeds above this point, at a definitely governed rate. The 18-volt storage battery is "floated" on the line in such a manner that the motor changes to a generator and back again to a motor, according as the electrical pressure rises or falls above or below that of the battery.

At engine speeds above a certain definite point it is a generator and below that point it becomes a motor, so that should



TRACTORS IN FIRE DEPARTMENT SERVICE.

KNOX-MARTIN TRACTOR, MT. VERNON, N. Y. WHITE TRACTOR, CLINTON, IA. SEAGRAVE TRACTOR, COLUMBUS, OHIO.
WHITE TRACTOR, OCEAN GROVE, N. J. AMERICAN-LA FRANCE TRACTOR. WHITE TRACTOR, CHICAGO, ILL.

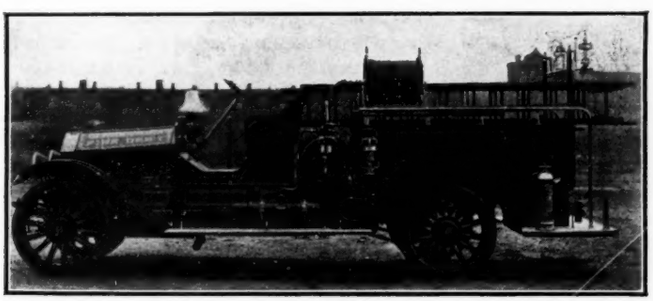
the engine stall in traffic the electric motor will automatically "pick it up" and restart it, without any attention on the part of the driver. It will be apparent that this should constitute a very valuable feature of the motive power of any piece of fire apparatus, where the delay incident to having to restart the motor by hand-cranking might be serious.

CHIEF'S CAR FOR WINONA.

The city of Winona, Minn., recently awarded a chief's car contract to the Mitchell-Lewis Company. This roadster carries two powerful fire extinguishers on the running boards. "In the rear compartment," states Chief Norton, "is a large chemical tank, entirely concealed, built to carry a pressure of 250 pounds to the square inch, while in the rear of that is a reel of fire hose 200 feet in length. By means of a by-pass and a valve, the contents of the big fire tank may be discharged thru a regular hose lead, should we happen to arrive at the scene of the fire when a 3-inch hose is available. Thru the 1-inch hose on the reel, with a small nozzle, the chemical may be sent against a fire in one minute after the chief arrives. One big efficiency feature of this rig is the fire-extinguishing equipment, which one man, making a speedy run to a fire, may use and do more effective work than two or three companies of firemen arriving later, no matter how complete their apparatus."

MOTORS START WHEN GONG SOUNDS.

The city of Orange, N. J., has completely motorized its fire department. The motor equipment consists of one 6-cylinder 60-h.p. motor hook and ladder truck; one 6-cylinder 60-h.p.



BOYD COMBINATION HOSE AND CHEMICAL.

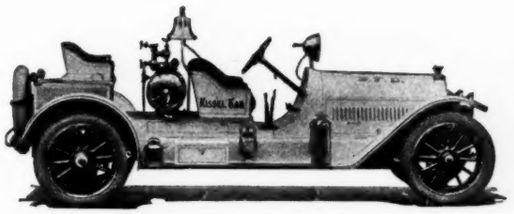
motor truck used as a tractor to motorize a horse-drawn hook and ladder; three 4-cylinder motor combination chemical and hose trucks, and a 4-cylinder 30-h.p. chief's roadster.

"Every piece of motor apparatus is equipped with an automatic starter," states Chief William H. Matthews. "Furthermore, all the motors are automatically started when an alarm is sounded. The self-starting switches are operated by a device synchronized with the alarm system and the engines are started the moment the gong sounds. In winter all of the machines are provided with warmers to keep the water in the radiators heated, thus preventing any delay due to the water and engine becoming chilled.

"One of our first motor-driven pieces consisted of a White motor combination chemical and hose truck. This machine, installed November 4, 1912, answered 162 alarms the first year at an operating cost of $51.83, including tires. For the second year of its service the cost advanced to $83."

PHILADELPHIA RAPIDLY MOTORIZING.

In its 1914 report the fire department, city of Philadelphia, Pa., makes the following mention of motor apparatus, showing an increase of $275,427.25 in motor apparatus as contrasted with a reduction of $21,866.30 in horse-drawn equipment:



KISSEL CHIEF'S CAR.

Motor-Driven.

Motor apparatus in use at the end of Dec., 1914	$138,514.58
Amount expended for motor apparatus in 1914	200,000.00
Total investment in motor-driven apparatus	$338,514.38

Horse-Drawn.

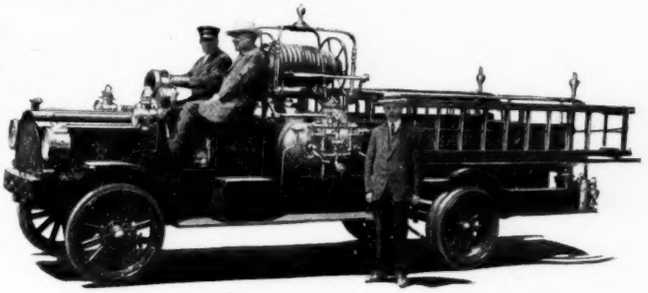
Horse-drawn trucks	$ 44,025.00
Combination chemical and hose wagons and water towers	90,275.70
Horse-drawn pumping engines	252,058.50
468 horses at $190	88,920.00
Total investment in horse-drawn apparatus	$475,279.20

BOSTON PROTECTIVE DEPARTMENT.

The Boston Protective Department, now operating four White motor trucks, as well as a roadster, submits the following report:

"One of our White trucks, placed in service August 7, 1912, has run about 12,000 miles and responded to more than 2,000 calls. The other three Whites were put in commission November 10, 1914, and, being new, have been called upon to do the brunt of the work ever since. These machines are of the 6-cylinder type, 60-h.p., 161-inch wheel base. They weigh 6,300 pounds empty and about 9,000 pounds equipped, not counting the men. Each of them carries twenty-five covers, 12 by 18 feet in size, and, in addition, a full supply of extra sprinkler heads, shut-offs, fusible links, plugs and caps for gas pipes, extinguishers, squeegees, axes, hooks, short ladders, life nets and other appliances. The Boston Protective Department is maintained by the fire insurance interests at an annual expense of about $115,000. It employs sixty-three permanent men, owns about 900 covers, with a full equipment of appliances for quick, practical work at fires. It has been in operation for nearly fifty years."

THE CITY OF McKEESPORT, PA., *purchased a 3-ton Packard truck, which was delivered on May 4, 1914, and which has since proved itself of great value in the McKeesport fire department. As the illustration shows, the truck is a combined chemical, hose and hook and ladder vehicle, carrying, besides several hundred feet of standard water hose, two chemical tanks and hose on reels, ladders, fire extinguishers, etc.*



LOW SIX MONTHS' RECORD.

The Young America Hose Company, Poughkeepsie, N. Y., submits the following report on a White combination placed in service in November, 1911:

"The operating cost per six months averages approximately $15, whereas the cost of keeping the team of horses displaced by the motor apparatus amounted to $260. This outfit, which is mounted on a regulation White 1½-ton chassis, carries both stationary and portable chemical tanks, and the full complement of hose, nozzles, extension ladders, hooks, axes, etc. The larger stationary chemical tank employs what is known as the Kanawha system, in which the creation of pressure does not depend upon the usual chemical action, but is accomplished by a powerful auxiliary air-pressure system. On the running board there is a steel tank of compressed air, with a conveniently located pressure gage. In the line from the air tank to the chemical tank there is a pressure regulating valve, enabling the firemen to admit air to the chemical in accordance with the requirements of the blaze or the consumption of chemical."

Big Reduction in Insurance

The fire department, city of Wilkes Barre, Pa., during the past year added nine pieces to its motor-driven list, bringing the total to thirteen. Of the eight companies, five are now completely motorized, effecting a saving of $8,000 per annum. Twenty-seven horses were eliminated.

Fire Chief Hochreiter furnishes the following conclusions:

"Our thirteen motor-driven pieces, which include seven combination chemical engines, one flying squadron car, one ladder truck and four pumping engines, average in upkeep $3 a month, which includes gasoline, oil and repairs. At this rate it costs $39 a month, or $468 a year, to keep thirteen pieces of motor apparatus.

"Aside from the tremendous saving effected by the elimination of twenty-seven horses, the Fire Insurance Underwriters reduced the cost of fire insurance in this city to the amount of $13,000 in premiums a year. This reduction was granted before the nine new pieces were purchased and before the full-paid department was established. It costs us less to keep thirteen pieces of motor apparatus than it does to keep one team of fire horses. The cost of keeping a piece of motor apparatus varies, as some months it may be driven to more fires than others. The tractor attached to No. 1 pumping engine one month cost as low as 90 cents and the tractor of No. 3 engine 60 cents."

Fighting Theoretical Fires With Building Plans

Director of Public Safety Carroll, Marshal David Walker and Battalion Chief Boughner, Fire Department, Grand Rapids, Mich., are inaugurating new safety measures whereby theoretical fires will be fought by means of building plans.

Plans are now being made of all the larger buildings in Grand Rapids. With these plans on file in the fire department the officials will be prepared to "fight a fire before it occurs." This is done in Cleveland and Detroit in particular with excellent results.

The officials each day take a plan of a building and then set an imaginary fire on one of the upper floors or in some other place difficult to reach. Imaginary lines are laid and the fight is waged on paper just as thoroly and with the same generalship that an army officer plans and executes a battle.

The plans enable the officials to learn the building thoroly and from the basement to the top floor the building is figuratively fired and extinguished. This system, coupled with the personal inspection of the buildings as now is being done, will insure a far greater measure of efficiency, it is believed.

TAKE PLANS TO FIRE.

Further, it is proposed to have these building plans carried to any large fire by the marshal. As executive officer he will be able to leave the detail work to his subordinates and give orders intelligently regarding the methods of conducting the battle which seem most certain of success.

Added to this system will be a closer relationship between fire department officials and the city building inspector. All changes in buildings will be noted as they occur and thus the possibility of the firemen meeting an unusual situation, such as was found in the St. Andrew's school fire, will be eliminated. Particular care is to be paid to the large furniture buildings in the city.

WILL LETTER FIRE HYDRANTS.

It is proposed also to letter all fire plugs with the size of the mains they open and the direction in which the mains run.

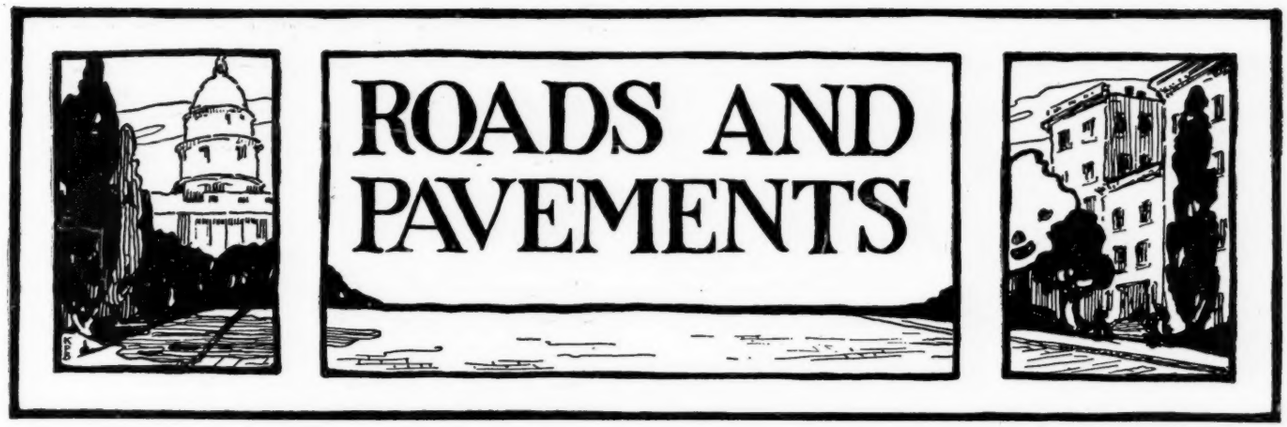
The captains of the various districts, of course, know exactly the size of the mains in their territory, but it is pointed out that a captain from the south end called to the north end may not be aware of the size plug to which he is attaching a line and the lettering will save valuable time and may avert serious complications. It frequently has occurred that two engines have been attached to a small main with the result that neither apparatus could do much good.

Fire Department Notes

William Guerin started in the New York fire department as a fireman in 1889, when Hugh Bonner was chief. He worked his way up the ladder, earning promotion through the successive grades of engineer, lieutenant, captain and deputy chief. He missed by a fraction of 1 per cent. appointment as head of the department, but

Bernard J. Reilly has been a member of the fire department of Ithaca, N. Y., for nearly twenty years. He was promoted to second assistant chief in 1913 and to chief of the department in 1914. Many improvements have been made in the department during the brief period of his administration, including a new automobile squad wagon, two teams of horses and 3,000 feet of hose, new insulated weather-proof wire for the fire alarm system and increase in number of alarm boxes and battery equipment. Additional hydrants have been put in and a system of daily inspection of all the hydrants has been inaugurated. Each fireman now has twenty-four hours off duty each ninth day.

William C. Dowty, chief of the fire department of Hamilton, O., has been in the department since 1878, as substitute driver two years, regular driver thirteen years, fire marshal two years and chief of the department ten years. The entire department will be motorized within the next year, having now chief's car, two hose cars with small chemical tanks, and a hook and ladder truck. The force now consists of twenty-nine men. The fire loss in 1914 was the lowest since 1905, and was only 41 cents per capita, $14,535 in all, altho the 281 alarms responded to made the record as to large number. The small loss is attributed to the motor apparatus and the extensive use of the chemical apparatus.



American Granite Block Pavements Improved to Equal Foreign Pavements

Stone cobbles, blocks or slabs, irregular or regular in shape, according to the abilities of the maker, laid on the ground in close contact, and rammed in place to provide a surface free from mud or dust for pedestrian or vehicular traffic, were the earliest forms of pavement, according to Henry Welles Durham in a paper before the Worcester Road Congress, and were almost the only forms until the invention of the road roller made possible sheet pavements from macadam or ground up to concrete and asphalt pavements.

The old streets of Pompeii show today pavements not inferior (if we disregard their narrowness, due to the different traffic conditions of earlier times) to those of many modern Italian cities, or for that matter, our own. There may be still seen ruts or grooves worn by traffic not dissimilar to photographs displayed as horrible examples by recent volunteer citizens' committees, to prove the impropriety of using for pavements any material subject to wear.

If by the expression "improved granite pavements" we seek to convey the impression that there has recently been discovered some marvelous new method for constructing pavements of stone blocks much superior to anything heretofore known in the history of the world, we shall be guilty of falling into the error so frequently incurred in this country, of supposing that all of the improvements in conditions we make are original with ourselves. What should be signified by the term, is the classification of those stone pavements suitable for present day traffic conditions, as opposed to the many makeshifts which have been permitted, either thru ignorance or lack of study, to disgrace the appearance of streets of American cities in past years, and which unfortunately, most frequently even at the present time, present themselves to the mind of the average citizen when the term "stone block" or "granite pavement" is used.

Looking briefly into the history of stone pavements in our country alone, it will be found that up to well into the latter half of the past century, pavements of cobbles were about the only type employed.

During this period and down to the last decade of the nineteenth century were introduced different types of squared stone block pavements varying from large slabs to small cubical blocks, and employing trap rock, granite, sandstone and limestone in accordance with the locality. Granite and trap rock being easily obtained for our more populous eastern cities, were largely used here, while for similar reasons, blocks of sandstone and limestone were introduced in the middle west, and basalt on the Pacific Coast.

About the time that sheet asphalt pavements were gaining in popularity in 1890, the pavements employing oblong granite blocks laid transversely to the axis of the road, and with joints filled with tar and gravel came into general use. The term "Belgian Block" was applied indiscriminately to this and to the earlier cubical trap blocks, from the fact that stone pavements were almost universal in Belgium, but as applied here, the name was somewhat libelous, as no citizen of Belgium, before its devastation, would have recognized any similarity between the so-called Belgian block streets of America, including Broadway and Fifth avenue, and those of his own country.

Very little improvement was made in American stone pavements for many years after the oblong paving block came into general use, although the bicycle first, and following it, the automobile, was creating demand for a street surface as durable and dustless as the old macadam had been, and this demand was being met by the introduction of continually improved forms of asphalt construction, as well as many types of smooth block, such as wood and brick.

Up to about 1909 it was popularly supposed in this country that stone pavements were of an inferior type. No serious attempt to obtain good faces on the blocks was undertaken. Specifications were not rigid, and there was no interest taken by the quarries in the production of a type of block which could be laid with joints narrower than from ¾ of an inch to an inch. They were from 7 to 8 inches in depth, frequently 12 or more inches in length, and not carefully selected as to width. Examples of the type that was then considered standard may be seen today in the temporary pavements which have been replaced over completed subway construction in New York City pending a final settlement of the back-filled material, and unfortunately, in the form of permanent pavements in many of the important streets in the heart of Boston, but the growing popularity of asphalt, brick and wood blocks, had been leading gradually to the cessation of the construction of new stone block pavements with the result that there was no market for the surplus product of the quarries. As an outgrowth of this situation, and at the instance of paving engineers in such cities as Newark, N. J., and Worcester, Mass., followed by those in New York City, certain of the more enterprising producers of granite initiated the production of more accurately shaped paving blocks which should approach to European first-class specifications. While it cannot be said that even yet we have reached the condition where paving blocks are turned out equal to the best abroad, still, considering the very high cost of labor in this country, we have succeeded in producing a block capable of laying a surface which will compare very favorably with the foreign type. It is in this sense that the term "improved granite pavements" is used to refer to those which have been constructed in the United States during the past six years. Comparison of conditions in regard to this type of road surface in our country and abroad, brings out a very strong contrast. Stone pavements there are taken as a matter of course for the streets in which they are considered desirable. There is

no well-defined modern or improved type as contrasted with the old. Engineers merely classify them in accordance with methods of construction deemed most suitable for varying conditions of cost, location, traffic, etc. This was brought out very clearly by the engineers attending the Third International Road Congress in London in 1913, from the different countries.

Brick Surface Affords New Lease of Life for Macadam

The utility of macadam as a base for brick pavement, after it has otherwise outlived its usefulness, has been proven again, this time in Cleveland. One of the fashionable thorofares of the eastern section of the city is Cedar Glen Road, extending from the intersection of Overlook Road and Euclid Boulevard to the city limits. The greater part of this distance is a slope of varying grade, and the rather heavy traffic is very largely made up of motor vehicles which exert more than their average tractive power when going up the hill. The road leads to the rapidly growing Cleveland Heights and Shaker Heights districts. All the vehicles used in this newest and smartest residence district average two trips a day at least over the road. Pleasure vehicles, delivery wagons and the heavy trucking that results from widespread building operations all use this route.

The original improvement was Telford macadam, laid with great care according to the most approved specifications. It was designed to be not only durable but to reflect an air of luxury. The heavy grade made winter conditions a menace to vehicles and, the chains on automobiles simply chopped it to pieces, doing sometimes as much as $1,000 damage in a single winter day.

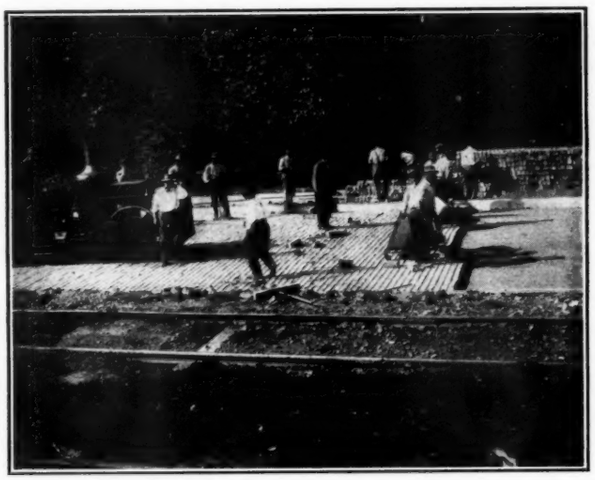
The surfacing was soon destroyed and the heavy stones of the Telford base projected. It was decided that repair was out of the question and that thoro resurfacing was needed. The consideration of materials led to the choice of brick.

The projecting portions of the base were removed by hand sledging and redistributed. In some cases, the broken chunks of stone were as much as four inches in diameter. After the irregularities had been removed, it was given a surface of slag, of about the size to pass a 2-inch screen and and be retained by a 1-inch screen. Smaller granulated slag was used to fill the interstices of this slag. The whole was then sprinkled and rolled to an even surface.

Upon this was placed a sand cushion, 1½ inches in thickness, which was given the customary treatment of rolling, striking off to grade and rerolling. Hillside block was used for the entire stretch.

The contract was completed in August of 1914, and the pavement has therefore had a year's test. Traffic has naturally increased very greatly.

An estimate of 3,000 vehicles a day, made during the current year, is probably rather less than the actual volume. The



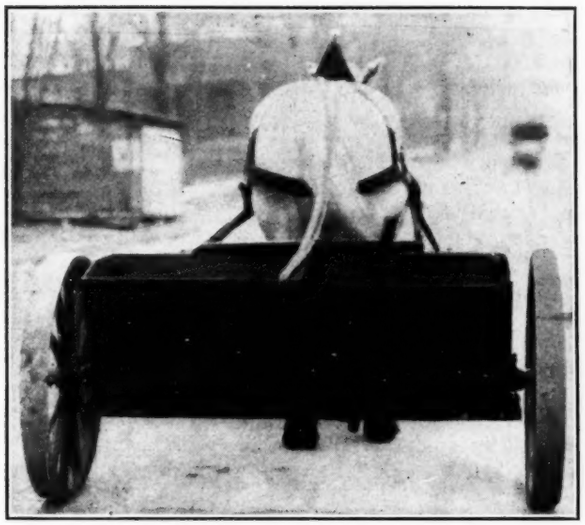
LAYING AND ROLLING *brick surface on old macadam base on Cedar Glen Hill, near Cleveland, O.*

TWO CONSTRUCTION VIEWS AND THE FINISHED BRICK ROADWAY • MORE THAN 3000 VEHICLES A DAY TRAVEL ON THIS HILL

results have been, on the whole, commendable and yet such as to point out certain necessities for this type of re-construction work. Perhaps the most important lesson is the necessity of thoroly compacting the base before the brick course is laid. This was particularly difficult to do here, on account of the extreme roughness of the old Telford macadam base and the necessarily varying thickness of the slag course.

The experiment is of particular interest in a locality where a large amount of macadam has been laid, constituting an investment that citizens are loth to see lost. Much of it is maintained at a cost which will make re-surfacing with brick an economy. This is particularly true upon the heavier grades, which are found abundantly in this section. Whether or not it would have been advisable on account of the heavy traffic to have laid a rigid base for the brick on Cedar Glen Hill, there is a considerable mileage of other roads and streets upon which the question of simple resurfacting with brick will arise, because of the desire to avoid the expenses of a rigid base.

The improvement in question follows the practice of Engineer Ett Smith of Mahoning county with respect to wornout rural road improvements, but was tried under vastly more trying conditions. It is a close approach to the dividing line between the road that may be resurfaced and the one which must be thoroly repaved. No one can doubt on inspecting the result that Cedar Glen Hill will afford satisfaction to the public for many years to come and that there is a wide field of usefulness for brick as a restorer of worn out roads that have been first improved with less enduring material.



Sanding Sidewalks in Slippery Weather

With the use of a homely, yet efficient sander, the number of accidents caused by icy sidewalks at Grand Rapids, Mich., has been reduced 95 per cent this season. A bin six feet long, two feet wide at the top and two feet deep was mounted on a pair of wheels. A piece of perforated steel, with rows of one-quarter-inch holes four inches apart extending the entire length was used as a bottom. Over this was placed a similar piece of steel, governed by a lever. The bin, filled with moist sand, is driven about the streets, leaving behind fifteen trails which afford ample protection to all pedestrians. Each load is good for a half-mile and the hill district is usually covered in one day.

Plans for motorizing the sanders and covering the walks of the entire city are now being figured on by Lewis D. Cutcheon, manager of the board of works.

Chicago Paved 147 Miles During 1915

M. J. Faherty, president of the board of local improvements, city of Chicago, has compiled a report showing that 147 miles of Chicago streets and alleys were paved during 1915. The aggregate cost was $4,500,000. The same report shows that during 1914 approximately 160 miles of paving work was done. Officials of the city say that probably the work to be done this year will total 200 miles.

FIFTY MILES OF ASPHALT.

The official report shows that during 1915 fifty miles were paved with asphalt. The other work done and the materials used were: Asphaltic concrete, 19.5 miles; asphaltic macadam, 34 miles; brick, 21.5 miles; creosoted blocks, 4 miles; granite blocks, 3.5 miles; concrete, 14.5 miles.

The new work was in many sections of the city, altho among the most important special assessment contracts were those in the South Chicago district, done at a cost of $196,500; the Cheltenham district, totaling $108,000, and Wentworth avenue, from Twenty-sixth to Thirty-ninth street, where creosoted blocks were used. The assessment for this work totaled $101,000. Other extensive improvements were made in Ravenswood, Englewood and in the Austin districts.

Oscar P. Chamberlain, vice president of the Dolese & Shepard Company, says that the heavy demand for crushed stone for street and road improvement during the year was for improvements thruout Cook and the neighboring counties.

ROAD BUILDING NORMAL.

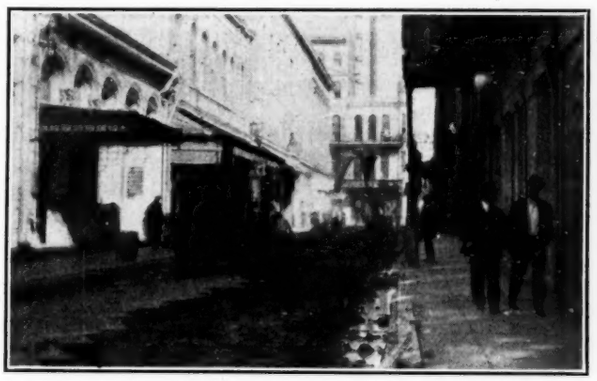
Practically normal conditions prevailed in outside road building and small town street improvements. The operation of the state-aid road law resulted in increased activity during the year.

Mr. Chamberlain estimates that approximately 1,500,000 yards of crushed stone were used in the city. He says that from September to the close of the year business increased 40 per cent. over the same period in 1914.

John A. McGarry, of the John A. McGarry Company, in summing up the paving activities, said the character of the work done in Chicago in 1915 compared favorably with similar contracts in any city in the United States. Mr. McGarry says the taxpayers are now getting work done at fair and reasonable prices.

From Ancient Granite to Modern Wood Block

In 1820, when the city of New Orleans, La., decided it was tired of miring in its muddy streets in wet weather, it cast about for paving material, of which there was at that time little variety. There was no stone in the vicinity of the city, so the municipal authorities offered a premium for Belgian blocks, sometimes brought to the port of New Orleans as ballast by vessels in the European trade. Those blocks were of large proportions, approximately 15 inches square on top and 12 or 14 inches deep. Many streets were paved with them, and their durability is evidenced by the fact that many still remain in place after nearly a century of use. A trip over them today in a wheeled vehicle is a jarring experience, and they are fast being removed to make way for modern pavements. The picture herewith shows the Belgian blocks in one of the streets of old New Orleans—Exchange street, adjoining Royal—torn up in November, 1915, to be replaced by up-to-date creosoted wood blocks, for which the city has recently given large contracts.



PAVEMENT NEARLY ONE HUNDRED YEARS *old being removed to replace with wood block.*

Good Roads Notes

That all the roads of a state cannot be improved simultaneously and that the most used arteries of communication command priority, is again exemplified in Missouri, where, at Sedalia, the Permanent Road Improvement Association was recently organized. Thirty cities of the state, including St. Louis and Kansas City, were represented in the meeting, the keynote of which was the great value to the commonwealth of connecting its centers of population and at the same time providing for ultimate attention to the feeder roads which will fit into the most important highways. The Permanent Road Improvement Association believes that there should be a logical federal co-operation with the several states, with federal

money utilized with state money in the building of the post roads, which must accept the greatest burden of traffic.

At present more than half of Arizona's prisoners are employed in highway and bridge construction camps. In addition to the fact that the utilization of prison labor in this way affords healthful employment for the men and encourages the upbuilding of character, it has been found that road and bridge construction accomplished under this plan is more thoro than that which can be obtained with day labor, chiefly for the reasons that the prisoners are kept steadily at one branch of work and become proficient therein, whereas day labor proves to be more or less transient. The cost of prison road construction, as compared with that performed under contract, does not vary materially, except in the quality of the work done. The preceding statement, however, does not apply to those road and bridge camps where honor men without guards are employed. In such camps the expense is so materially reduced as to constitute in itself an additional indorsement of prison labor. The plan of employing prisoners on highways, generally speaking, has worked out admirably in Arizona, and now receives the hearty indorsement of those officials under whose immediate supervision the roads and bridges are built. It has proved to be both humane and practical.

A recent trip over the Quebec-Miami route, known now as the Atlantic Coast Highway, showed that it was possible, by making some slight detours, to travel from New York to Jacksonville, 1,000 miles, by the route selected, with less than 150 miles of uncompleted highway, in stretches of 1 to 27 miles, all graded and some being surfaced, only about 25 miles remaining unprovided for when the work in progress is completed.

Crushed stone dealers of Indiana, after a two days' convention, worked out standard specifications for macadam road construction which the dealers will attempt to have county commissioners thruout the state adopt in ordering road improvements. The association engaged the services of prominent engineers to aid in forming the specifications. Fred W. Connell, secretary of the organization, will have charge of the campaign of education among the county commissioners. At their banquet Edward Barrett, state geologist, spoke on "Why Macadam Roads?"; J. R. Fleming on "Value of Good Roads;" Charles A. Caruth, of the New York state highway department, on "Macadam Highways."

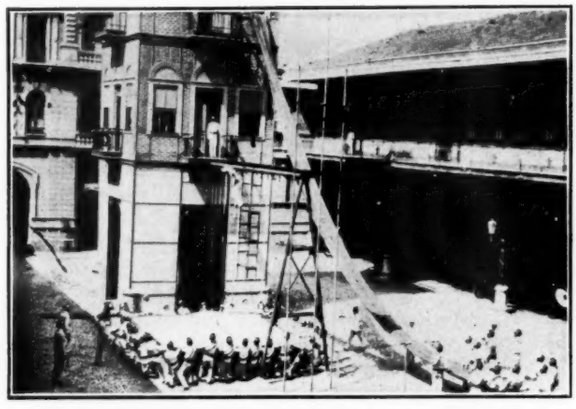
Paving for Minneapolis

The city council of Minneapolis, Minn., has the following comprehensive plan of street improvement under consideration, with prospect of completing the whole, as it is the result of numerous conferences of the council committee on paving and represents the general opinion as to what improvements should first be made:

Central avenue and Division street, between Central avenue and east city limits	$180,000
Minnehaha and Twenty-seventh avenues S., between Twenty-seventh and Fiftieth streets	149,000
Lowry avenue N. E., between Marshall street and east city limits	115,000
Seventh street N., between Hennepin and Plymouth avenues	99,000
Lyndale avenue N., between Twenty-sixth and Forty-second avenues	95,000
Chicago avenue, between Lake and Thirty-ninth streets	59,000
Fourth street N. E., between Lowry and Thirteenth avenues	40,000
Fourth avenue S., between Lake and Thirty-eighth streets	30,000
Blaisdell avenue, between Twenty-sixth and Elroy streets	30,000
Nicollet avenue, between Thirty-eighth and Forty-second streets	26,000
Royalston avenue, between bridge and Sixth avenue N.	25,000
West Twenty-second street, between Hennepin avenue and Lake of the Isles boulevard	23,000
West Twenty-fourth street, between Hennepin and Irving avenues	13,000
Total	$884,000

Fire Department Drill in Rio de Janeiro, Brazil

Rio de Janeiro, Brazil, has a well organized and equipped fire department, one of the best in South America. The photograph shows the tower used by the department for training and drilling the men. A man is about to drop into the life net shown on the left and held by some forty men. A long canvas tube used for life saving is seen on the right of the tower. It is attached to a third-story window and the lower end is held out by a number of men. Fire victims and their rescuers slide thru this tube to safety, one after another. Men are seen holding the end of the tube out so that it can be used without



the slider striking the ground until he has lost his falling velocity in the flat part of the canvas near the bottom, in which his weight causes a sag to aid in this.

The tower is used also to train men in scaling walls with and without ladders and it is a familiar sight during drill hours to see a man clinging to whatever projections he can find and thus gaining confidence and facility which he can make use of on buildings actually on fire.

Portland Cement Production in 1915

An estimate of Portland cement produced in the United States in 1915, just made by Ernest F. Burchard, of the United States Geological Survey, indicates that the shipments from the mills amounted to 86,524,500 barrels, compared with 86,437,956 barrels in 1914, an increase of 0.1 per cent; the production was about 85,732,000 barrels, compared with 88,230,170 barrels in 1914, a decrease of 2.8 per cent; and the stocks of finished cement at the mills were about 11,583,000 barrels, compared with 12,893,863 barrels in 1914, a decrease of 10.2 per cent. The slight decrease in production and the considerable decrease in stock indicate greater caution in the industry, which in the preceding few years showed a tendency toward overproduction.

Increases in production in the Lehigh, Michigan and Northeastern Indiana, Iowa and Missouri, Southwestern, and two southeastern districts were offset by decreases in the other six districts.

Clean Streets in Philadelphia

A system of operating the street cleaning force of the city of Philadelphia has been worked out by the Bureau of Highways and Street Cleaning, of which William H. Connell is the head, which has materially increased the quantity of work done and improved its quality at the same time that the force employed has been slightly decreased. As it stands at present the street cleaning work is done under several systems, which are adapted strictly to the work to be done and the conditions on each individual street, and the number of cleanings per week is determined according to the traffic and the cleanliness as to their streets of the inhabitants of the various districts into what the city is divided. The various classes of work have been described by Mr. Connell in reports and papers about as follows:

Hand Patrol—The blockmen are assigned to sections designated by the chief of the Bureau of Highways and Street Cleaning, the area to be covered by each blockman depending upon the character and amount of traffic and ranging from 4,000 to 20,000 square yards per day. The duties of the blockmen consist of patrolling these areas, gathering all paper or other refuse, and sweeping street dirt as it accumulates and placing it in dustproof bags or metal cans, after which these bags or cans are collected and loaded into special wagons and hauled to a collection station or dump.

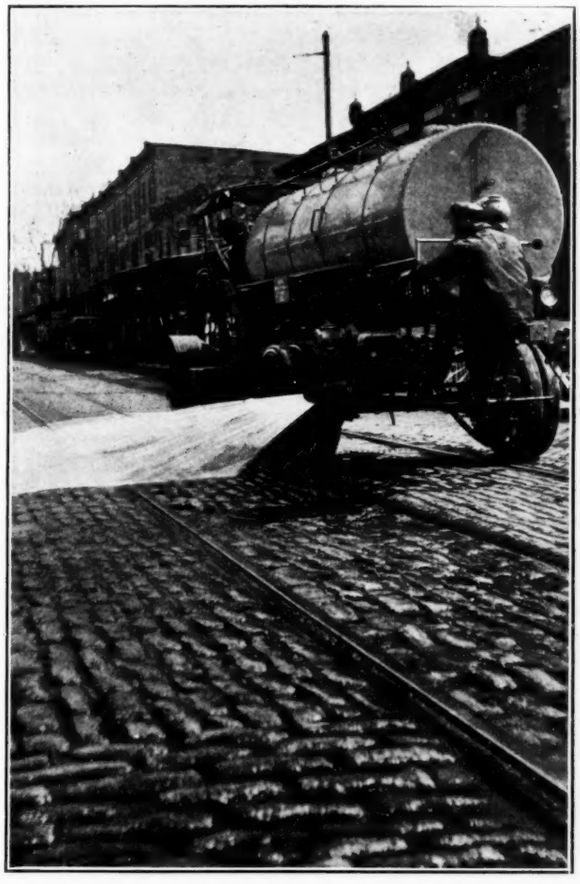
The equipment used in the hand patrol work consists of hand machines, bag carriers, burlap sacks, push brooms, pan scrapers, sprinkling cans and shovels. The dirt collected is placed in sacks and left at convenient points to be taken away by special wagons to the dump, the sacks being returned to the drivers. Sacks are generally used in preference to cans because of the weight, bulk and noisiness of the latter.

Machine Broom Cleaning—All machine broom cleaning is done in batteries of two or three, preceded by sprinklers, the number of brooms in each battery depending upon the width and character of the streets to be cleaned, the average gang consisting of two machine brooms, one sprinkler, four to seven gangmen, and a sufficient supply of carts or wagons to remove the sweepings, the number depending upon the length of haul to the dumps and the season of the year, together with the amount and character of traffic.

Squeegee Cleaning—Squeegee cleaning is used on smooth pavements. The operation consists of batteries of two and three squeegee machines preceded by sprinklers to soften and loosen the material on the streets, the sprinklers using as much water as possible without flooding the pavement; the squeegees using just enough water to create a wash. The idea of sprinkling in advance of the squeegees is to soften the dirt and enable the squeegees to cleanse the streets of all slime as well as the coarser materials. The squeegees are followed by two men, who immediately sweep up the windrows of dirt into piles, and a sufficient number of carts follow to remove the dirt from the streets. A photograph shows a gang of squeegee cleaners.

Flushing—Flushing machines are used only on the poorly paved streets and block pavements. The high-pressure flushing machines two of which are mounted on auto trucks, are usually operated singly, as most of the districts have but one flusher. A photograph shows the effect of the flusher on an old granite block street in removing the dirt between the stones as intended.

AUTOMOBILE FLUSHER, *Kinney type, on old granite block street. Note how well it washes out the joints between blocks, which in this case is the desired result.*



Alley Cleaning—All alleys and streets whose width between curbs is too narrow to permit the use of machine brooms, are cleaned once each week with a hose. When such streets or alleys are required by schedule to be cleaned more than once a week, the additional cleaning is done by hand brooms.

Hose Flushing—A hose flushing gang comprises a foreman and eight men, and operates in the heavy traffic business section of the city. The work is supplemental to the regular gang cleaning and to the blockmen cleaning and is done at night. The work is slow but thoro, the main object being to remove the fine dust and pavement detritus. Approximately 30,000 square yards can be cleaned in 10 hours by each gang.

A gang is equipped with hand brooms and 150 feet of hose with necessary attachments. One man operates the hose, the remaining men scrub the surface of the street, clean out the depressions and the gutters.

Inlet Cleaning—All inlets on paved streets and alleys are cleaned as often as necessary to keep them at all times free from obstructions, this work being done by special inlet gangs consisting of three men and a sufficient number of carts.

Country Road Cleaning—The cleaning of suburban and country streets and roads is taken care of by gangs, each consisting of one foreman, ten laborers and two carts. The work consists of pick-up cleaning, trimming the shoulders, opening and keeping the gutters clean, cleaning inlets, removing all refuse, rubbish and debris from the streets and such other work as may be necessary to keep the streets and roads in "spick-and-span" condition. The respective streets and roads are cleaned at least once every two weeks, and where necessary once or twice a week. The yardage of waterbound macadam, bituminous and concrete streets and roads, cleaned by the country road gangs is approximately 3,835,217 square yards.

The accompanying table shows the amount of work done in cleaning streets in 1915, per month, the percentages done by each method in use and the percentage of the total cost which the work done by each method bears to the total cost. It also gives the actual cost from the foremens' reports and the unit costs per 1,000 square yards cleaned and per cubic yard of dirt removed.

Of the methods used the hose flushing costs the most per

DEPARTMENT OF PUBLIC WORKS
BUREAU OF HIGHWAYS AND STREET CLEANING PHILADELPHIA PA.
STREET CLEANING COST DATA
MONTHLY STATEMENT
1915

CLASS OF WORK	SQUARE YARD CLEANED PER MONTH	CUBIC YARD OF DIRT REMOVED PER MONTH	PER CENT OF		ACTUAL COST			COST BY CONTRACT		
					TOTAL COST	UNIT COST		TOTAL COST	UNIT COST	
			WORK	COST	FROM DISTRICT Foreman's Report	TO CLEAN PER 1000 SQ. YDS.	PER CU. YD. DIRT	MONTHLY SUM PAID BY CITY	TO CLEAN PER 1000 SQ. YD.	PER CU. YD. DIRT
MACHINE BROOM	144 424 000	22 372	62.3	42.9	39 462	.273	1.77	44 074	.305	1.97
SQUEEGEE	48 051 000	1 538	20.8	9.4	8 678	.170	5.65	9 657	.200	6.28
FLUSHER (HORSE)	8 044 000	#2	3.4	1.7	1 560	.194	—	1 746	.217	—
FLUSHER (AUTO)	#1 3 180 000	#2	1.4	0.8	780	.200	—	822	.258	—
ALLEY CLEANING	8 046 000	856	3.4	4.3	3 972	.494	4.64	4 418	.550	5.16
HOSE FLUSHING	807 000	#2	0.4	0.4	397	.492	—	411	.510	—
ROADWORK	19 175 000	5 144	8.3	7.7	7 059	.368	1.37	7 911	.413	1.54
INLET CLEANING	#3	3 426	—	4.2	3 864	.018	1.13	4 315	.020	1.26
BLOCKMEN	#4 147 933 000	7 458	—	28.6	26 380	.178	3.54	29 383	.198	3.93
TOTALS	#4 231 727 000	40 794			92 152			102 737		
AVERAGE		0.177 CU.YD PER 1000 SQ YD		#5	MACHINE WORK HAND WORK	.248 .334	2.10 1.84	MACHINE WORK HAND WORK	.276 .455	2.55 2.12

#1 AUTO FLUSHER COST IS BASED UPON 75,000 S.Y. CLEANING PER DAY PER FLUSHER AT A CHARGE OF $5.00 PER DAY (10 HR.) PER FLUSHER. FLUSHERS FINISH THEIR SCHEDULE AND HELP ON HORSE FLUSHER AND SQUEEGEE ROUTES

#2 DIRT REMOVED BY BLOCKMEN #3 APPROXIMATELY TWO INLETS PER 1000 SQ YDS.

#4 BLOCKMAN YARDAGE NOT INCLUDED IN TOTAL #5 HAND WORK DOES NOT INCLUDE INLET OR BLOCKMAN WORK.

NOTE: THE ABOVE COSTS INCLUDE THE COLLECTION AND DISPOSAL OF THE DIRT GATHERED, AND ARE BASED UPON RATE PER TEN HOUR PAID BY THE CONTRACTOR FOR LABOR AND EQUIPMENT. THESE RATES ARE AS LISTED BELOW.

BLOCKMAN WORK CONSISTS OF PICK-UP CLEANING AND IS ENTIRELY SUPPLEMENTAL TO MACHINE CLEANING.

WATER COST IS NOT INCLUDED IN THE ABOVE FIGURES. THIS COST @ 4¢ per 1000 GALLONS AMOUNTS TO $15,555.36 — 388,884,000 GALLONS BEING USED.

CLEANING AREA OF PAVED STREETS & COUNTRY ROADS — 1,408.2 Mi. — 21,248,318 SQ.YD.

COMPUTED ANNUAL COST — TOTAL $1,101,792 — PER MI. $782.35 — PER 1000 S.Y. $51.85

ANNUAL COST TO CITY BY CONTRACT $1,232,847 — " " $875.55 — " " " $58.02

POPULATION (ESTIMATED 1915) 1,675,000 COST PER CAPITA — COMPUTED $0.658, CONTRACT $0.736

CONTRACTOR'S LABOR & EQUIPMENTS RATES USED IN ABOVE COMPUTATIONS

Superintendent	$4.00 per 10 hr. day	Dirt Cart - Driver & 1 Horse	$3.50 per 10 hr. day
Foreman	3.50 " " "	Sprinkler - " " 2 "	5.00 " " "
Ass't Foreman	2.00 " " "	Machine Broom - Driver + 2 Horses	5.50 " " "
Gang Laborers	1.75 " " "	Squeegee " " " "	6.00 " " "
Blockman	1.50 " " "	Flusher " " " "	7.50 " " "
Dirt Wagon - Driver + 2 Horses	5.00 " " "	Flusher (Auto) Chauffeur + Helper	15.00 " " "

THREE SQUEEGEE MACHINES *runing in a gang, preceded at some distance by a street sprinkler to soften up the dirt on the pavement.*

1,000 square yards, machine broom next, then auto flusher, horse-drawn flusher, blockmen and squeegee in the order named, the squeegee costing less than 40 per cent as much as hose flushing. This is true of both actual cost and cost by contract, except that blockmen and squeegee change places, the two costing very nearly the same in both cases.

Activated Sludge Experiments in Brooklyn, N. Y.

About a year ago we published an account of the experiments on sewage treatment in progress in a plant constructed for that purpose by the sewer department of the Brooklyn, New York City. Some of these experiments were based on the experimental work of the Massachusetts State Board of Health, which was the basis also of the experiments of Gilbert J. Fowler of England, which resulted in the particular process now bearing the name of activated sludge.

The process in principle is the same as that of the percolating filter, where the sewage drops slowly thru a mass of material with many voids in which aeration of the sewage and growth of aerobic bacteria take place which have the effect of breaking up the construction of the organic matter in the sewage and converting it into innocuous gases and sludge. The activated sludge process aerates the sewage directly and moves the activated sludge thru the liquid instead of moving the liquid thru the sludge resting on the particles of filter medium.

In a paper before the American Association for the Advancement of Science, George T. Hammond, who has charge of the Brooklyn experiments, describes his experiments during 1915, using the activated sludge process as developed by Mr. Fowler and a number of variations of it, to discover the maximum efficiency of the process, the range of variation practicable, the cost under various conditions, and the like. From these experiments, which are as yet far from completion, Mr. Hammond draws some preliminary conclusions and draws some inferences which he states are subject to modification when he has obtained further information from the results of his future work.

The work done so far does not seem to justify any very positive conclusions, while it does offer considerable promise. No conclusions adverse to the method have been reached, tho it does not as yet show any advantage in economy or reliability over other well-known methods, such as the Imhoff tank, followed by the percolating filter and settling tank.

Some of the problems that are engaging the attention of investigators are the effect of relatively low temperature in winter on the process; how the nitrogen in the sludge can best be built up; how much sludge will be formed under various conditions of operation, and whether a cycle or process of operation employing a series of tanks can be devised in such manner that all of the easily reducible organics will be removed from both sewage and sludge; how much sludge will be available for the manufacture of fertilizer, and whether all that is of value may not be required for use in the continuous flow plan of sewage treatment to diminish the time of aeration to a minimum.

There is probably a condition of equilibrium to be secured in the treatment under which just about so much sludge will be used by the process to obtain a required result, and just about such a surplus will have to be disposed of. How to adjust the method to the varying strength and quantity of the sewage as it flows to the plant, and the effect of varying strength of sewage on the expense of the treatment, also requires much study.

The efficiency of the method in regular service under the ordinary operation conditions that prevail in all American cities, its cost and economy, and its reliability as compared with other methods of sewage treatment now well known and giving good and cheap service, cannot but engage the careful study of conversative men, whose object usually is to provide the most economical method of treatment which shall offer the greatest promise of efficiency and reliability under existing requirements and circumstances.

Much remains to be learned of the new method along these lines; and while, to the scientist investigating it in the experimental plant it seems so promising, a word of caution should be given to the engineer charged at present with designing a sewage treatment plant. Judgment should remain suspended until more definite information is available on the points above mentioned.

Underground Water Resources of States Determined

The United States Geological Survey for a number of years has been prosecuting, largely in co-operation with the state surveys, a systematic study of the ground-water resources of all the Coastal Plain states. Reports have been issued, either by the Federal Survey or by co-operating state geological surveys, for Virginia, North Carolina, Georgia, Florida, Alabama, Mississippi, eastern Tennessee, Kentucky and southern Illinois, southeastern Missouri, southeastern Arkansas and Louisiana, northeastern Texas, the Black and Grand Prairie areas of Texas, and the area underlain by Tertiary formations in Texas south of the latitude of Jefferson and east of Brazos river. The manuscripts of papers on the ground-water resources of Delaware and Maryland, on the ground waters of northeastern Arkansas and on the ground waters of La Salle and McMullen counties, Texas, have been completed and will be published during the next fiscal year, and additional studies of the ground waters of Mississippi are in progress. Comprehensive studies of the ground-water resources of the Coastal Plain of Texas west of Brazos river are also approaching completion.

With good health recognized as one of the great national assets, the extent of this study of underground-water resources furnishes a measure of its value to the public. Reports have been published covering 376,000 square miles in the Atlantic and Gulf states, reports on 27,000 square miles are completed tho not yet published, field work has been completed on 50,000 square miles, and work is contemplated to cover 16,000 square miles. These areas of nearly half a million square miles include the parts of the United States in which impure water supplies involve the greatest danger. The value of such surveys in conserving public health has already been demonstrated, for it has been noted that wherever an adequate supply of deep-well water has been obtained, typhoid fever, amoebic dysentery and malaria have abated.

MISCELLANEOUS

The March of Events

Feb. 2-5, at Claypool Hotel, Indianapolis, Ind. The Indiana Sanitary and Water Supply Association meets, having joint sessions and banquet with the Indiana Engineering Society on Friday, Feb. 4. Dr. W. F. King, secretary, State House, Indianapolis.

Feb. 3-5, at Claypool Hotel, Indianapolis, Ind. The Indiana Engineering Society meets, those on the 4th being joint meetings with the Indiana Water Supply and Sanitary Association. Chas. Brossmann, secretary, Merchants Bank Building, Indianapolis.

Feb. 4-5, at Chicago, Ill. The American Electric Railway Association holds its seventh annual midyear meeting.

Feb. 9-11, at Columbus, O. The Ohio Engineering Society holds its annual meeting. John Laylin, secretary, Norwalk, O.

Feb. 10-11, at Engineering Societies Building, 29 West Thirty-ninth street, New York. The Illuminating Engineering Society will hold its midwinter convention, features of which will be a special presentation of an honorary membership to Thomas A. Edison at a banquet at the Biltmore, on the eve of his birthday.

Feb. 10-12, at St. Paul, Minn. The Minnesota Surveyors and Engineers Society will meet. At the dinner on the 11th Prof. F. H. Newell, of the University of Illinois, will be the principal speaker.

Feb. 12-19, at Coliseum and Armory, Chicago. The ninth annual cement show will be held. R. F. Hall, secretary, 208 North La Salle street.

Feb. 14, at Auditorium Hotel, Chicago, Ill. The Building Inspectors' Conference will be held. Rudolph P. Miller, chairman, 100 Morningside Drive, New York.

Feb. 14-17, at Chicago. The American Concrete Institute will meet. John M. Goodell, secretary, 1418 Walnut street, Philadelphia, Pa.

Feb. 15-18, at Chicago. The National Conference on Concrete Road Building will be held. J. P. Beck, secretary, 208 South La Salle street, Chicago, Ill.

Feb. 16-18, at Des Moines, Ia. The Iowa Engineering Society will meet. J. H. Dunlap, secretary, Iowa City, Ia.

Feb. 17-18, at Chicago. The American Concrete Pipe Association will meet. E. S. Hanson, secretary, 538 South Clark street, Chicago, Ill.

Feb. 21-22, at Hotel Statler, Cleveland, O. An important meeting of the National Paving Brick Manufacturers' Association will be held. Will P. Blair, secretary, B. L. E. Building, Cleveland, O.

Feb. 21-26, at Washington, D. C. The United States government departments will hold a "safety first" exhibit, and on Feb. 24 a conference of state mine inspectors will be held at the office of the Bureau of Mines.

Feb. 28-March 3, at Mechanical Hall, Pittsburg, Pa. The annual convention and road exhibit of the American Road Builders' Association will be held. E. L. Powers, secretary, 150 Nassau street, New York.

March 6-10, at Sohmer Park, Montreal, Que. The third Canadian and International Good Roads Congress will be held by the Dominion Good Roads Association. Geo. A. McNamee, secretary-treasurer, 909 New Birks Building, Montreal, P. Q.

May 8-10, at Waco, Tex. The Southwestern Water Works Association will hold its annual convention. E. L. Fulkerson, secretary, Waco, Tex.

May 10-17, at Indianapolis, Ind. The National Conference of Charities and Corrections will hold its annual conference.

June 15-16, at Cleveland, O. The Ohio Society of Mechanical, Steam and Electrical Engineers will hold its annual convention. Joseph L. Skeldon, president, Toledo, O.

Sept. 6-9, at Newark, N. J. The League of American Municipalities will hold its annual convention.

December. The American Highway Association has passed resolutions declining the invitation to hold joint sessions with the American Road Builders' Association in February and approving of the new American Association of State Highway Officials, which will hold its next convention in December, 1916.

Joint Cement Exhibit

An important part of the joint exhibit of the cement manufacturing companies at the Chicago Cement Show will be the road display. The United States Government road models, which were exhibited at the Panama-Pacific Exposition, will be a feature of the concrete road division which should prove interesting to road builders. Full-size pavement sections, built to show road inspectors and contractors the errors of construction to be avoided, will be well worthy of careful study.

One section of the joint exhibit will be devoted to good vs. bad concrete. A 2,000-pound testing machine and other laboratory apparatus will be used to show that graded materials are more economical and make better concrete than bank run aggregates.

Builders who visit the show to study equipment, however, will have ample opportunity to investigate the standard machines of the industry. More comprehensive displays of equipment are possible because of the greater amount of display space which the Armory offers. Concrete mixers, block and brick machines, engines, pumps, hoists, crushers, forms for monolithic concrete, machines for sewer pipe and drain tile, road-building and contractors' equipment will be shown in greater number and variety than last year.

Technical Association Notes

The American Association of Enginers will issue to its members a monthly called *The Monad*, devoted to the objects of the association, "to raise the standing of ethics of the engineering profession and to promote the economic and social welfare of engineers."

At its meeting on January 13, the Brooklyn Enginers' Club heard a paper by A. W. Dow on preservative oils for the treatment of wood paving blocks.

Technical Schools

The Municipal University of Akron, O., makes a specialty in its technical work of co-operation with machine shops, railroads, contractors and builders and the municipality, whereby students accompany their academic work with practical experience, beginning at the bottom, as section hands on a railroad, for example, amplifying to some extent the plan which has been in operation at the University of Cincinnati for some years. Fred E. Ayer is the dean of the College of Engineering.

Robert M. Raymond has been appointed professor of mining in the Columbia University Graduate School of Mines, succeeding Prof. H. S. Munroe, who retired last June, after thirty-seven years of service in the position.

Five research fellowships, each of $500 a year for two years, will be vacant in the Engineering Experiment Station of the University of Illinois at the close of the present school year, and nominations will be made in February. Those interested should communicate with the director of the Engineering Experiment Station, Urbana, Ill.

The Massachusetts Institute of Technology has made arrangements to test the samples of materials to be used in the construction of the new dry dock under Edward F. McSweeney, chairman of the directors of the port. The Institute is aiding another state department, the Fire Prevention Commissioner, in determining the flash points of inflammable fluids. These are indications of the desire of the Institute to place its facilities at the disposal of the public as represented by departments in the government.

The short course in highway engineering at the University of Illinois, January 10 to 21, was a little longer than some of those held by the state universities and included in its program many experts, including Dr. Newell, head of the civil engineering department; W. S. Gearhart, state engineer of Kansas; W. W. Marr, H. E. Bilger, B. H. Pirepmeier, Clifford Older, F. L. Roman, S. E. Bradt, A. D. Gash and James P. Wilson, of the Illinois State Highway Department; A. R. Hirst, state highway engineer of Wisconsin; T. H. MacDonald, state highway engineer of Iowa; Dr. L. I. Hewes, of the U. S. Office of Public Roads; several members of the university and other university faculties, several county highway superintendents and such experts in highway materials as W. P. Blackwood, of the Barber Asphalt Paving Co.; James A. Cannon, of the National Refining Co.; A. L. Kuehn, of the American Creosoting Co.; Philip P. Sharples, of the Barrett Manufacturing Co.; C. M. Powell, of the Universal Portland Cement Co.; Prof. C. C. Wiley, instructor in highway engineering, and Prof. N. B. Garber, instructor in bridge engineering, held two-hour sessions each day with each of two sections for detailed instruction in highway and bridge design, construction, maintenance and repair, the nine days allowing a very satisfactory detail in the programs. Altogether, the program was one of the most elaborate and satisfactory yet presented by a road school not limited to college graduates.

The good roads schools this winter include one at Purdue University, Lafayette, Ind., under the direction of the School of Civil Engineering. The University of North Carolina will have a good roads institute in the month of February. Cornell University will devote a week to good roads instruction February 14-19. The University of Tennessee, at Knoxville, has provided for a short course in highway engineering. The University of Illinois held a similar course in January. The University of Michigan will do likewise February 21-25. The University of West Virginia has just completed its third annual session in the School of Good Roads. A post-graduate course in good roads is now being given at the Iowa State College, January 3 to February 26. A special course, under the direction of the highway department of the College of Civil Engineering for the education of county road officials, will be given in February at the State University of Kentucky at Lexington. Illustrated lectures on highway construction have been one of the special features of the work at Columbia University, New York, during the winter. A special course in road building and maintenance has recently been concluded at the Maryland Agricultural College. The University of Pittsburgh holds one January 31-February 5, and the Wisconsin Highway Commission on the same dates.

Will This Meet a Poet's Eye?

The Committee of One Hundred on the 250th anniversary of the founding of Newark, N. J., offers thirteen prizes of $50 to $250 each in gold for the most acceptable poems on subjects related to the anniversary, to be in the hands of the editor of *The Newarker*, Committee of One Hundred, Newark, N. J., on April 10, 1916, from whom full particulars can be obtained.

The City Manager in Johnson City, Tenn.

Wm. R. Porter, who is one of the governing body of Johnson City, Tenn., has written a defense of the city manager plan as compared with the commission plan of government, showing the experience in that city, the amendment which is needed to perfect its system and the defects in the commission form as it is proposed to apply it in that city. From his article some of the statements are abstracted as follows:

In 1909 an amendment to the charter of Johnson City, Tenn., was secured authorizing the employment of a city manager. The city ordinances designated him "The City Commissioner," until recently. We have had three combination managers and engineers in that time. For several years we have had 75 per cent. of the benefits of this city manager plan. All we now need to enable the city to embrace all the benefits of the plan, is one simple charter amendment, and a broader conception of the functions of a city manager. The amendment should limit the activities of the governing body to legislating; selecting a manager, and seeing that he manages properly or makes room immediately for one who will. It does not matter whether this governing body be called Board of Mayor and Aldermen or Board of Commissioners. What does count is that the number of its members is kept large enough to make it a representative body and make corruption of the government difficult; and that its powers and the manager's powers are defined and limited with exactness in the charter amendment. It would not be necessary to change otherwise a charter which has stood the test of time, and was prepared with great care to fit this one city.

Government by a small commission puts all a city's interests in peril, sooner or later. Opposition to that form is based on questions of economy, effectiveness and safety of the public's interests. Of those cities now working under the city manager plan, a large number first tried out this commission plan, and discarded it. Look at some of our own Tennessee cities. The courts are ousting city commissioners right along for crookedness in office. How does this happen under a form of government which is reputed to cure all the ills of a municipality, according to local agitators? Just this: this commission system puts into the hands of a small clique—three or

five men—the absolute control of all legislation and the intimate direction of the business of the city, with no restraining influence above them except that bit of deceptive bait, recall by the voters. A few representatives of the outraged public had to get the courts to oust the delinquent commissioners.

Galveston's New City Hall

Galveston, Texas, is just completing a new city hall and auditorium at a total cost, including site, of $320,000. The city offices occupy a four-story building at one end of the group, the fourth story being allowed for future growth, as the officers just moving in will all be accommodated in the lower three stories. The auditorium is completed and is now in process of furnishing. It has a capacity of 5,000 persons with seats provided for 4,000, a stage, movable floor and two balconies. Ramps are used instead of stairways. The auditorium will be open for conventions, for which Galveston has heretofore provided no special facilities, and can be used for any form of entertainment.

Commission Government in Birmingham, Ala.

Birmingham, Ala., has been operating for some years under three commissioners according to the usual form of commission government, but last September the voters authorized a change of the number of commissioners to five. Geo. B. Ward, who has been mayor and commissioner for some time and was formerly mayor of the city under the mayor and council system, becomes president of the new board of commissioners, head of the department of finance and president of the board of education. The other commissioners will have charge of the departments of public justice, including police and recorder's courts, streets and highways, public health, sanitation and education, and public buildings and public utilities.

Motor Trucks in Business

In 1910, there were less than 10,000 motor trucks in use in the United States. It is conservatively estimated that today there are 100,000.

Every business that gives delivery or haulage service must use motor trucks nowadays in order to keep up with competition. The obvious arguments for trucks are these:

1. That they cover more ground than horses.
2. That they make possible a greater radius of delivery—hence patronage.
3. That they are more reliable.
4. That, if kept busy, they are cheaper.
5. That they are a good advertisement.

Blasting a Ditch

James T. Myers, of Callam Bay, Wash., blasted a ditch 3,270 feet long and averaging 2 feet, 10 inches deep, with dynamite in 17 days without help, reclaiming a number of acres of land. It carries off the water formerly flooding the land and has required no shoveling out of caved sides of the ditch since it went into operation.

Civil Service Examinations

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

February 2—Physical laboratorian at Naval Proving Ground, Indian Head, Md., at $3.84 a day.

February 2, 3—Surveyor in Engineer Department at Large, War Department, at $90 to $150 a month.

February 15—Topographic and sub-surface draftsman in Navy Yard, Philadelphia, Pa., at $4.48 to $5.04 a day; master mechanic in Frankfort Arsenal, War Department, Philadelphia, Pa., at $2,400 a year.

March 15—Aid, Bureau of Standards; aid, Coast and Geodetic Survey; computer, Coast and Geodetic Survey; draftsmen, copyist topographic and topographic in Departmental Service, Engineer Department at Large; marine engine and boiler and ship in Navy Department; forest assistant in Forest Service; junior engineer, mechanical or electrical, Engineer Department at Large.

April 12—Assistant observer, Weather Bureau; civil engineer and draftsman, Departmental Service; computer, Nautical Almanac Office and Naval Observatory; computer and estimator, Supervising Architect's Office; draftsmen, architectural, in Supervising Architect's Office, topographic and mechanical in Panama Canal Service; junior chemist, Departmental Service; junior civil engineer, Engineer Department at Large; laboratory assistant, Departmental Service.

Personal Notes

Frank C. Perkins, M. E., of Buffalo, N. Y., proposes a state or municipal hydro-electric power plant to utilize the 4,400 second-feet of water which can still be drawn by the United States from Niagara river above the falls, under the treaty with Canada. He would also utilize 600 second-feet used to dilute the sewage of the city of Niagara Falls, which now goes to waste.

Thomas D. Lindsay has been appointed superintendent of public works for Ansonia, Conn.

Richard B. Williams, Jr., is the new commissioner of public works of Syracuse, N. Y., and Henry C. Allen returns as city engineer after two years' vacation.

Paul E. Mercier, who has been acting city engineer of Montreal, Que., has been appointed chief engineer of public works of that city.

Clarence W. Marsh, recently director for the Hooker Electro-chemical Co. and others, has established an office as an independent consulting and chemical engineer in the Boston Safe Deposit and Trust Co. building, 201 Devonshire street, Boston, Mass. He mentions specially the manufacture of electrolytic caustic soda, bleach and chlorine products among the subjects in chemical and allied industries in which he can render service as investigator, advisor and organizer.

Ray S. Blinn, who has been city engineer of Mt. Vernon for several years, has been elected city manager of Westerville, Ohio, under the new commission charter, at a salary of $1,500 a year.

Clarence W. Hubbell has opened an office at 2334 Dime building, Detroit, Mich., for practice in consultation, design and supervision of construction in sewerage, sewage disposal, water supply and municipal engineering, with three associates in civil, mechanical, sanitary, chemical and bacteriological lines. Mr. Hubbell's experience includes several years in charge of the engineering department of the Detroit water works and in municipal engineering in Manila and the Philippine Islands.

Clifford Older, bridge engineer for the Illinois State Highway Commission, has been elected president of the Engineers' Club of Springfield, Ill., now two years old, and with a membership of 130. The club meets the second Monday night of each month.

F. W. Ballard, of the Cleveland municipal lighting plant, has opened offices in the Swetland building, Cleveland, Ohio, for the practice of engineering and architecture under the title of F. W. Ballard & Co. He publishes a bulletin on some essentials of ornamental street lighting, the first of a series which together will describe the Cleveland municipal lighting plant, its construction and operation.

Blaine S. Smith, general sales manager of the Universal

Portland Cement Co., has been elected general secretary of the Chicago Association of Commerce.

Robert N. Kinnaird, chief engineer of the Des Moines Water Co., is president of the Iowa section of the American Water Works Association.

Lindell Theodore Bates has opened an office at 71 Broadway, New York, for the practice of law, with special regard to French, Spanish and South American affairs.

George H. Norton now has the title of city engineer, Department of Public Works, Buffalo, N. Y., a promotion to which his excellent service for the city fully entitles him.

Mayor Smith of Philadelphia has appointed the official family for the administration upon which he has just entered, and it includes George S. Webster, director of wharves, docks and ferries, who has long been an efficient employe of the city in various capacities; Joseph H. MacLaughlin, director of supplies; William H. Wilson, director of public safety; Dr. Wilmer Krusen, director of public health and charities, and George E. Datesman, director of public works, all new faces in their departments.

Carl C. Widener, Bozeman, Mont., was elected president of the Montana Institute of Municipal Engineers, which held a very successful three-day convention at Billings, January 17-19. The society practically covers its field with its thirty-four members.

Miles C. Riley and Howard F. Ohm have opened an office in the Washington building, Madison, Wis., for the practice of law, paying special attention to drafting and codification of national and state laws, compilation, analysis and annotation of court and commission decisions, both of them having had some years of experience of special value to them for this class of work.

Frederic H. Fay, chairman of the committee on municipal and metropolitan affairs of the Boston Chamber of Commerce, and a member of the firm of Fay, Spofford & Thorndike, consulting engineers of Boston, gave an illustrated paper on "The Boston Metropolitan District" before the Detroit Engineering Society on Friday evening, January 21. Representatives of the Detroit Board of Commerce attended the meeting. Mr. Fay laid emphasis on the duty of engineers to give themselves to some extent to public service, because so many of the problems of a municipality are of an engineering character. He outlined the work of the committee, of which he is chairman, as displayed in its constructive interest in the larger municipal problems of Boston, in keeping watch of legislation, reporting on public improvements, offering suggestions regarding the solution of important problems and aiding, with the prestige of the chamber, in putting thru measures which appear to be for the public good.

W. Mont Ferry is mayor of Salt Lake City and commissioner of public safety under the new commission which has just taken office. Two of the five members are holdovers, and the other three are experienced in city affairs as officeholders, Mayor Ferry having been for years a member of the old city council and its president.

Publications Received

F. W. Ballard has reprinted in convenient form the most important points made in his paper before the conference on valuation held under the auspices of the Utilities Bureau in Philadelphia, in November, 1915, upon "Some Essentials of Appraisal Work."

Bulletin 314 of the U. S. Department of Agriculture is a professional paper from the office of Public Roads and Rural Engineering by Prevost Hubbard, chemical engineer, and Charles S. Reeve, chemist, which brings down to date the methods for the examination of bituminous road materials in use by the department, describing in detail the pieces of apparatus and the methods of using them.

"Laboratory Tests of a Consolidation Locomotive," by E. C. Schmidt, J. M. Snodgrass, and R. B. Keller has been issued as Bulletin No. 82 of the Engineering Experiment Station of the University of Illinois. The tests whose results are recorded constituted the first work done in the recently established locomotive laboratory of the University of Illinois and relate to a typical consolidation locomotive.

"Principal and Practice of Cost Accounting" is a treatise on the subject of manufacturing costs designed to meet the needs of accountants, manufacturers, mechanical engineers, teachers and students, written and published by Frederick H. Baugh, P. O. Box 682, Baltimore, which has for its object a comprehensive and practical presentation of the general principles upon which cost accounting for manufactured articles is based, the application of these principles and the illustration of details. 180 pp. $3.

First annual report of the Iowa State Highway Commission, from April 9, 1913, to December 1, 1914. Thos. H. MacDonald, state highway engineer, Ames, Iowa.

Twenty-eighth annual report of the Street and Sewer Department of Wilmington, Del., A. J. Taylor, chief engineer.

The Cleveland, Ohio, municipal lighting plant is fully described, particularly as to investment costs, engineering features and operation costs, in Bulletin No. 2, issued by the Department of Public Utilities, Division of Light and Heat, by F. W. Ballard, commissioner and chief engineer. It fully answers all criticisms which have been made of the plant and shows that the plant is profitable, altho the rates charged for its service are much lower than those formerly charged by the private company serving the territory before the municipal plant was built.

The eighth annual report of Pasadena, California, Municipal Lighting Works Department, by C. W. Koiner, general manager and electrical engineer, shows the pronounced success of this municipally owned and operated plant under continuous expert technical and financial management, which was subjected in its earlier history to the same kind of attacks now made on the Cleveland lighting plant and has fully demonstrated that the attacks were wholly unwarranted.

Annual Report of the Board of Street and Water Commissioners of Newark, N. J., for 1914, Morris R. Sherrerd, chief engineer, Department of Public Works.

Forty-eighth annual report of the Commissioners of Water Works, Erie, Pa., for 1914. Geo. C. Gensheimer, secretary and treasurer.

Technologic Paper No. 44 of the U. S. Bureau of Standards is a preliminary report of an investigation of the durability of cement drain tile in alkali soils and shows that rich concrete and very careful construction are necessary in strong alkali soils.

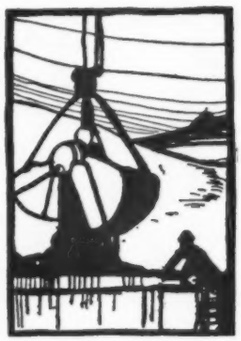
Sixteenth annual report of the Water and Light Department of Duluth, Minn. D. A. Reed, manager.

State highway mileage and expenditures to January 1, 1915, are the subjects of Circular No. 52 of the U. S. Department of Agriculture, prepared by the division of road economics, Office of Public Roads and Rural Engineering.

The annual report of the city engineer of Moline, Ill., Lyle Payton, is in pocket-book size, but is full of statistical information of value, including water, sewer and paving maps.

Invincible America, a plan of constructive defense, is the subject of a pamphlet by Harry G. Trave, of New York, in which he proposes a military organization for the men engaged in national improvements and the extension of construction by the U. S. Government to roads, as a measure of defense as well as of service to the people.

"Methods of Washing Slow Sand Filters," by John Gaub, chemical engineer of the filter plant at Washington, D. C., describes and illustrates the methods in use, and will be sent by Mr. Gaub on request.



MACHINERY AND SUPPLIES

Atlantic Electric Trucks

A recent important development in motor transportation is the electric truck which is now furnished by the Atlantic Electric Vehicle Company, of Newark, N. J., in four sizes, with capacities of 1, 2, 3½ and 5 tons, respectively. The claims of advantage for the electric truck are cleanliness, no odors or smoke, lessened fire danger to vehicles or load, less insurance on garage, all points in favor of the motive power used; no noise, ease of starting and control, excessive speed impossible, less space needed at loading platform, shipping shed or in garage, and maximum carrying space for wheel base.

The saving by using mechanical haulage is from 15 to 50 per cent. of the cost of hauling with horse and wagon, the amount of saving depending on character of loads, time required to handle them, average haul per load, hours of work and number of miles a day and grades on the roads traveled, but the saving is always positive with reasonable management.

The designs of the Atlantic electric trucks follow standardized practice as to proportion and size of parts, quality of material and workmanship, so that there is no experimenting done at the expense of purchasers. Moreover, the duty of the company does not end with the sale of its vehicles, but they have a complete service department to aid in the proper care and upkeep of their vehicles. The specifications for all parts show the highest quality of materials and workmanship.

As to the parts special to electric vehicles: The batteries may be either Exide batteries of the lead-plate type, with acid electrolyte, or Edison batteries of the nickel-iron-plate type, with alkaline electrolyte. They are suspended in cradles beneath the frame and can be unloaded from either side.

The battery charging equipment furnished is determined by the kind of current available to the purchaser; with alternating current a mercury arc rectifier for a small number of trucks or a motor generator set for a larger number; with direct current a charging panel adapted to the voltage of the current. Appliances for high-rate charging can also be supplied if desired.

The illustration herewith shows a 5-ton truck for delivering building materials and gives an idea of the substantial design and construction of the truck, chassis and body and the attention paid not only to strength and durability, but to ease and convenience of handling.

M. & W. Oil Engines

Although a product of some twenty years standing in the engineering field, the M. & W. oil engine embodies several novel principles which have only recently begun to be established on the plane of standard practice. Two decades have thus vindicated the wisdom of the designers who have produced an engine which will operate successfully on kerosene, crude oil, fuel oil, alcohol or distillate, yet is totally without carbureting apparatus, so-called mixing valves or electrical ignition devices.

This engine is of the two-stroke cycle type, in which the preliminary air compression for scavenging takes place in the crank case. Air compressed in the crank case by the downward movement of the piston is at the proper moment admitted to the compression space above the piston by means of the usual by-pass found in engines of the two-stroke cycle type. Compression of the air in the combustion space due to the upward movement of the piston raises the temperature to within a very few degrees of the ignition point of the fuel which is at the proper moment sprayed into the cylinder and against the projecting lip of an "ignition ball" which, after preliminary heating by a blow-torch, maintains its temperature at or above the ignition point due to combustion temperature in the cylinder.

Since the fuel is sprayed directly into the combustion chamber shortly before completion of the compression stroke, there can manifestly be no loss of fuel thru crank-case leakage or thru exhaust ports, neither is the supply of lubricating oil in the crank case subject to deterioration because of dilution with the liquid fuel, as is the case in all types of two-stroke engines which compress a carbureted fuel mixture in the crank case. M. & W. oil engines are built in the horizontal stationary type in sizes from 2 to 300 h.p.; in the vertical stationary type in sizes from 2 to 400 h.p.; and in the vertical marine type in sizes from 2 to 600 h.p., the latter in sizes from 45 to 600 h.p., being in themselves directly reversible and requiring no reversing gear whatever.

A large number of M. & W. oil engines have recently been installed, among the purchasers being the following:

Melchior, Armstrong & Dessau, New York City, 30 and 40-h.p.

Wayne Cold Storage Company, East Williamson, N. Y., 80-h.p.

Dill Machine Company, Philadelphia, Pa., 50-h.p.

American Steamship Line, New York City, two 35-h.p. direct connected generator sets.

American Mineral Company, Johnson, Vt., 100-h.p. This plant also has an 80-h.p. engine in operation.

Atlantic Fruit Company, New York City, 12-h.p. generator set. This concern has several Mietz & Weiss oil engines in operation.

Pennsylvania Railroad Company, Altoona, Pa., eight 40-h.p. engines direct connected to generators.

Shipley Construction & Supply Co., Brooklyn, N. Y., three 50-h.p. single cylinder horizontal engines.

Baer Bros., Stamford, Conn., one 150-h.p., making the second unit of this size in this plant.

McCreery Machinery Company, Seattle, Wash., two 150-h.p. Mietz & Weiss direct reversible marine oil engines.

Swayne & Hoyt, San Francisco, Cal., one 200-h.p. Mietz & Weiss direct reversible marine oil engine.

Harding Creamery Company, Omaha, Neb., one 150-h.p.

Hind Steel & Wire Works, Huntington, L. I., 50-h.p., making two of these units in this plant.

American Trading Company, New York City, one 30-h.p.

Albert R. Reynolds, Silver Lake, N. H., 50-h.p.

These engines took the medal of honor, one of the highest awards offered at the Panama-Pacific International Exposition. They are well-known all over the world, and are in extensive use by the United States and foreign governments, as well as by private interests in all classes of service.

Auto Truck Snow Plow

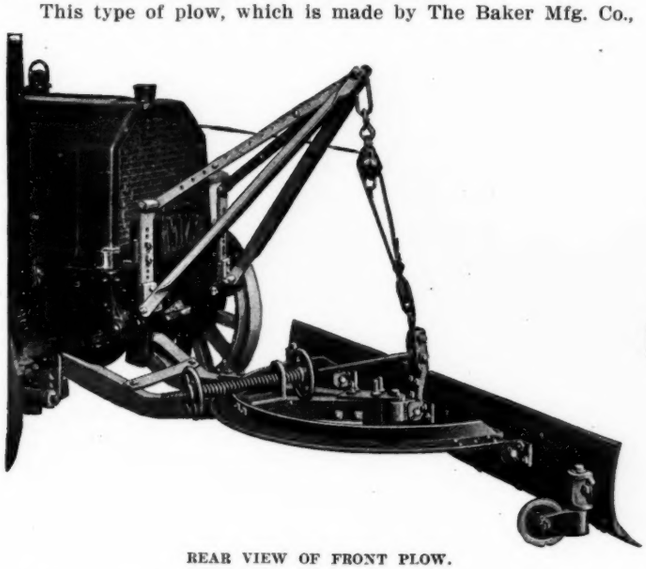
We are illustrating a type of front truck snow plow, such as has been successfully tried out by the city of Chicago, with the result that they have ordered two or more front and one rear plows.

The front plow blade is hinged to supporting circle, so when any obstruction is encountered it trips and prevents damage to plow or truck. Heavy springs restore blade to working position when obstacle is passed. Hand wheels adjust tension of springs. Blade is easily lifted by rope from seat of truck.

The blades may be set both same way or in opposite directions, thus throwing the snow to one or both sides. Blades are reversible and can be set at any angle desired. Weight of front plow, 550 lbs.; rear plow, 1,300 lbs.

The rear plow has offset hitch. Thus the furrow thrown by front plow is taken up by rear and moved over another six feet. Blade of both front and rear plow is carried on adjustable casters or set firmly on pavement as desired. Blade of rear plow is easily controlled by lever from platform. Flanged rear wheels effectually prevent skidding.

This type of plow, which is made by The Baker Mfg. Co., Springfield, Ill., may be attached to any standard auto truck. Blades are eight feet long. Each plow (front and rear) cleans a space six feet wide as rapidly as the truck travels. Thus at one operation a path twelve feet wide is cleaned at a speed of twelve to fifteen miles per hour.



REAR VIEW OF FRONT PLOW.

Dustless Refuse Collection

The Mesco sanitary refuse collection vehicle is designed to provide a sanitary system of odorless and dustless ash and garbage collection and to minimize the strain put upon the workmen in the ordinary collection of such refuse. No special can is required for this system. The ordinary can in general use and sanitary cans of various types and widths can be used in conjunction therewith.

When loading, the operator by means of an endless chain simultaneously raises the hoisting crane and at his option places in position the right or left monorail and roller conveyor, together with the running board underneath. The loaded cans are then clipped to the steel cable pulley tackle and raised by means of motor power to the roller conveyor, and guided to the closed hopper mouth. Tipping the can causes its weight to open the hopper and its contents to be deposited into the body of the truck, while the removal of the can automatically closes the hopper mouth. During the operation of emptying, the tapering hopper has provided a sealed connection, preventing dust or offensive odors escaping into the atmosphere.

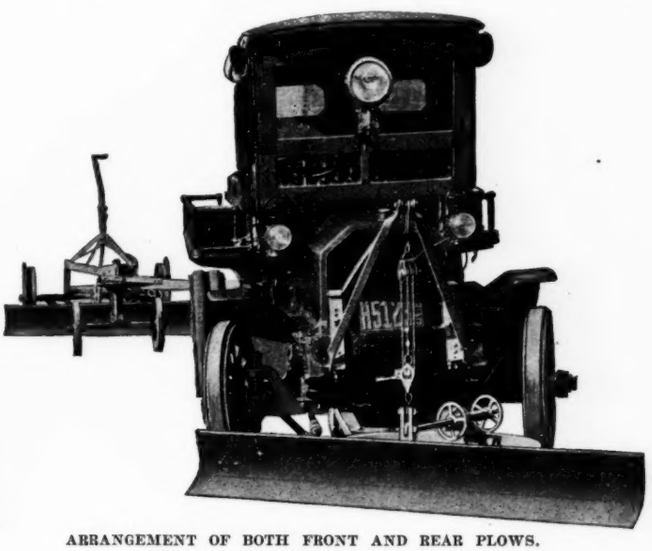
The Packard hydraulic hoist used to dump the vehicle consists of a hydraulic cylinder using ordinary gas engine oil. The actuation is by an oil pump attached to the base of the cylinder.

Power for driving the geared pump is taken from the propeller shaft or from a special Packard power drive mechanism directly attached to the transmission. The entire pumping apparatus can be controlled by the driver without leaving his seat. This hoist will elevate a 6-ton load to a 55-degree angle in 20 seconds, and the body will return to its lowered position in 12 seconds. The angle of 55 degrees secures clean scavenging.

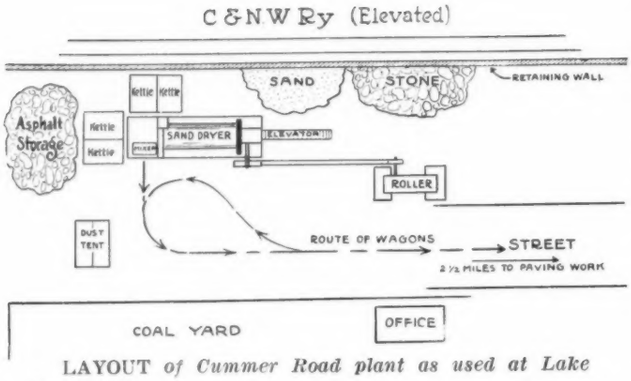
The machines, whether hand or automobile, are sold by M. Eberhart & Son Co., 76th street at First avenue, New York.

750 Yard Asphalt Plant Turns Out 1,200 Yards of Asphaltic Concrete per Nine-Hour Day

An average of over 1,200 square yards of 2-inch asphaltic concrete pavement per nine-hour day was the record made by



ARRANGEMENT OF BOTH FRONT AND REAR PLOWS.



LAYOUT *of Cummer Road plant as used at Lake Forest, Ill.*

Contractor H. G. Goelitz, Oak Park, Ill., on a contract for paving five streets in Lake Forest, Ill., using a Cummer 3-unit, 750-yard capacity road plant. This record is especially noteworthy on account of the unusually wet weather conditions which prevailed and which made it impossible to run the plant continuously. In spite of the speed at which the work was carried on, the asphaltic concrete, according to those in charge of the work, was of good quality. The sand and stone, usually wet when entering the drum, were turned out thoroly dry and heated to the required temperature of 325-340 degrees, and the mixer performed equally good service in producing a uniform and highly satisfactory concrete.

The yardages of the various streets were as follows:

Spring Lane	1,342.4 sq. yds.
Mayflower Road	8,036.3 sq. yds.
Lake and Hawthorne	4,791.0 sq. yds.
C. H. McCormick driveway	1,185.0 sq. yds.
Total	15,404.7 sq. yds.

The C. H. McCormick driveway, as indicated by the name, is a private street, and the paving was paid for by the owner, altho the work was done simultaneously with the city streets.

All the streets are located in the residential district of Lake Forest, but the locality is so sparsely settled that they partake somewhat more of the nature of roads than streets, and the pavements were made only 18 feet wide. The old pavements were of macadam, somewhat rutted and with numerous pot holes in the surface. Owing to light traffic it was thought unnecessary to put in concrete foundations, and the asphaltic concrete was laid directly over the old macadam after the latter had been scarified, brought to the proper grade and thoroly rolled. Concrete combined curb and gutters were put in on each side.

The asphalt plant was located near a coal yard along the Chicago & Northwestern railroad, near the northern limits of the village, enabling all materials, sand, stone, asphalt and coal, to be readily assembled. The sketch shown on this page gives a good idea of the layout of the plant. Cars of asphalt (in barrels), sand and stone were "spotted" on a railway siding opposite the plant, the materials being unloaded by hand to the positions shown. The sand and stone were wheeled from the piles to the elevator in barrows.

A 10-ton tandem steam roller furnished the power to drive the machinery of the asphalt plant, being connected by belt.

Four asphalt kettles placed as shown on the diagram, adjacent to the mixer, were kept in continuous operation. The heated asphalt was dipped out of the kettles into the weighing apparatus above the mixer.

Aggregates consisted of crushed limestone ranging in size from ½-inch down, lake sand and limestone dust, the last named material coming in sacks and being stored in the tent shown on the diagram. One mixer batch was made up by weight, as follows:

Asphaltic cement	55 lbs.
Limestone dust	55 lbs.
Aggregates	590 lbs.
Total	700 lbs.

With a haul of about 2½ miles from the plant to the job, six wagons were necessary to transport the asphaltic concrete as fast as the plant turned it out. The average time necessary for the round trip was 1¼ hours.

Seventeen men, including the foreman, were found to be the most economical crew for operating the plant. The crew was made up as follows: One foreman, one mixerman, one drum fireman, one weighman, one dustman, one dipperman, one kettleman, one engineer and nine laborers; total, 17 men.

The work of the nine laborers comprised unloading of cars, wheeling sand and stone, stripping asphalt and loading kettles.

The asphalt plant was put in operation on this work on October 28, 1915, and turned out the last batch on December 8, 1915, making a little over a month's work. Records show that for producing 14,062.3 square yards of asphaltic concrete for the Mayflower, Lake and Hawthorne roads and the C. H. McCormick driveway, the plant was running only 117 hours. During that time it turned out a computed amount of 16,044 square yards, i. e., the contractor made the asphaltic concrete

PHOTOGRAPH OF CUMMER ROAD PLANT IN OPERATION AT LAKE FOREST, ILL.

somewhat thicker than 2 inches in place on the street. Dividing the computed yardage by the number of hours the plant was at work gives 137.1 yards mixed per hour, or 1,233.9 yards per nine-hour day, certainly a good record for a road plant rated at only 750 yards per ten-hour day.

Owing to the excessive rains and poor transportation facilities, the maximum number of hours worked on any individual day was seven hours, and the maximum yardage produced in one of these seven-hour days was 1,229 square yards.

The asphaltic concrete mixture called for in the specifications was as follows:

Bitumen	6½	to 8	per cent.
Mineral passing 200 mesh	6	to 10	per cent.
Mineral passing 80 mesh	6	to 15	per cent.
Mineral passing 40 mesh	10	to 25	per cent.
Mineral passing 10 mesh	10	to 20	per cent.
Mineral passing ¼ mesh	10	to 20	per cent.
Mineral passing ½ mesh	5	to 20	per cent.

The asphalt plant was not a new one and had established a good record for itself the previous year in Evanston, Ill. The streets paved in this city were as follows:

	Sq. Yds.
South street boulevard—	
Sheridan road to Chicago avenue	5,989
Ridge road to Northwestern elevated	4,623
Sheridan road—	
South boulevard to Main street	12,000
Forest avenue—	
Main street to Greenwood	4,830
Total	27,442

Work on this system of roads was begun on September 19, 1914, and finished on October 31, having worked parts of twenty-nine days and about twenty-five full days of nine hours each.

The computed yardage turned out in this time was 27,115, or 1,085 yards per day of nine hours. The maximum day's run was 1,415 yards, nearly double the rated capacity of the plant.

Owing to the fact that the traffic on the Evanston streets, particularly Sheridan road, a much-used automobile thorofare, is much heavier than on those in Lake Forest, a greater percentage of stone was used in the asphaltic concrete mix. An average mix was about as follows:

Bitumen	7 per cent.
Mineral passing 200 mesh	9 per cent.
Mineral passing 80 mesh	10 per cent.
Mineral passing 40 mesh	19 per cent.
Mineral passing 10 mesh	15 per cent.
Mineral passing ¼ mesh	15 per cent.
Mineral passing ½ mesh	25 per cent.
	100 per cent.

The kinds of aggregates were about the same as those used in Lake Forest. One mixer batch was made up by weight as follows:

Asphaltic cement	44 lbs.
Limestone dust	80 lbs.
Aggregate	575 lbs.
Total	699 lbs.

The layout of the plant was much the same as at Lake Forest, being located on the west branch of the Chicago & Northwestern railroad, about two miles from the job. The make-up of the plant crew and the method of handling aggregates were the same. The streets were paved somewhat wider than those in Lake Forest, some having a macadam base and others a concrete base. They are all giving excellent service.

Those in charge of the engineering part of the Lake Forest work were James Anderson, Jr., city engineer of Lake Forest, and Lester Kirschbraun, consulting chemist, Chicago, Ill. Wililam Long is city engineer of Evanston, and Lester Kirschbraun was also consulting chemist in this work.

Recent Patents

The following patents of interest to readers of this journal recently were issued from the United States Patent Office. Copies thereof may be obtained from R. E. Burnham, patent and trade-mark attorney, 881 Bond Building, Washington, D. C., at the rate of 20 cents each. State number of patent and name of inventor when ordering.

1,162,790. Prepared mortar. Clyde M. Long, Toledo, O., assignor of one-half to John M. Losgar, same place.

1,163,058. Sewage-treatment plant. Thomas J. Belfranci, Oroville, Cal., assignor of one-half to Marie C. Belfranci, same place.

1,163,050. Artificial stone. Grosvenor Atterbury, New York, N. Y.

1,163,087. Fire extinguisher. Augie L. Hansen, Chicago, Ill., assignor to Justrite Mfg. Co., same place.

1,163,096. Tunnel construction. Duncan D. McBean, New York, N. Y.

1,163,176. Locking device for hoisting apparatus. William Rutan, New York, N. Y., assignor to Gillis & Geoghegan, New York, N. Y.

1,163,169. Brake mechanism for hoisting apparatus. Edward Pavelka, New York, N. Y., assignor to Gillis & Geoghegan, same place.

1,163,189. Manhole and cover for the same. John S. Wolf, Yonkers, N. Y.

1,163,321. Electrical water-purifying appliance. Has Clark, Kansas City, Mo., assignor of two-thirds to John R. Green, Oklahoma, Okla., and Thomas T. Bathurst, Kansas City, Mo.

1,163,334. Water filter. Arthur L. Gammage, Everett, Mass.

1,163,355. Cap for hose connections. Jonathan C. Meloon, Providence, R. I., assignor to General Fire Extinguisher Co.

1,163,375. Form for concrete. James R. Selfridge, San Francisco, Cal., assignor to Selfridge Holding Co., same place.

1,163,376. Form for concrete. James R. Selfridge, San Francisco, Cal., assignor to Selfridge Holding Co., same place.

1,163,377. Concrete-pile form. James R. Selfridge, San Francisco, Cal., assignor to Selfridge Holding Co., same place.

1,163,480. Mold for building poured concrete structures. Lyman C. Stewart and Marshall A. Quinn, Roanoke, Va.

1,163,497. Extension boom. Nils E. Anderson, Miami, Fla.

1,163,593. Manufacture of asphalt cement from natural asphalts. Charles N. Forrest, Rahway, N. J., assignor to The Barber Asphalt Paving Co., Philadelphia, Pa.

1,163,624. Sewer cleaner. William J. Stevenson, Philip A. Fuchs and William Hiecke, Jr., Milwaukee, Wis.; said Fuchs assignor of one-twelfth of the whole right and said Hiecke of one-twelfth of the whole right to said Stevenson.

1,163,633. Power shovel. Edwin J. Armstrong, Erie, Pa., assignor to Ball Engine Co., same place.

1,163,634. Power shovel. Edwin J. Armstrong, Erie, Pa., assignor to Ball Engine Co., same place.

1,163,640. Culvert form. James M. Cooper, McLeansboro, Ill.

1,163,641. Adjustable false work. Robert A. Cummings, Pittsburgh, Pa.

1,163,825. Machine for preparing road wearing surfaces. Livingston S. Kasson, New York, N. Y., assignor to The A. L. Barber Asphalt Co., same place.

Trade Notes

Warren Brothers Company have removed their principal offices from Temple Place to 142 Berkeley street, Boston, Mass., near the Back Bay railroad station, and a large area of bitulithic pavements on important streets in this neighborhood.

The Kissel Motor Car Company reports a very brisk interest in its new worm drive truck, both on the part of the dealers and the public generally. This truck, which is built to carry a ton, seems to be the most popular size, and the Kissels will make a specialty of it. At the same time they will produce five other models, as in the past.

The combined open-feed water heater and hot water meter known as the Cochrane metering heater, exhibited at the Panama-Pacific Exposition by the Harrison Safety Boiler Works, Seventeenth street and Allegheny avenue, Philadelphia, has received the gold medal award. This apparatus is designed to heat boiler feed water by means of exhaust steam from engines, pumps, etc., and simultaneously to meter the water and record the rate of flow, and to integrate the total flow in any elapsed period. This enables the engineer or plant owner to determine how many pounds of steam are being evaporated per pound of fuel burned under the boilers, and hence to compare the different fuels, different methods of firing, etc. It also shows the effect upon boiler efficiency of cleaning soot and scale ofi heating surfaces, stopping up air leaks in furnace and settings, and other improvements in operation, and furnishes the means whereby the methods of obtaining high efficiency may be discovered, standardized and maintained.

The South Bend Foundry Co., South Bend, Ind., makers of municipal and all other kinds of gray iron castings, have now the largest and best equipped jobbing foundry in Indiana, excepting Indianapolis, with C. C. Lee, formerly with the E M F and Studebaker Corporations, as superintendent.

The Aberthaw Construction Co. have removed their offices to the Niles building, 27 School street, Boston, Mass., where they may have more commodious offices.

It is estimated that more than 4,000 American farmers are now using motor trucks. This is about 4 per cent. of the total number of trucks sold in the United States. These vehicles have nearly all been bought within the last two or three years, indicating a swiftly proved economic success, a supposition greatly strengthened by a recent careful canvass of the Kissel Motor Car Co. Of the numerous Kissel-Kar trucks in agricultural service, there was not an owner found who had any regrets at having purchased the truck, while not a few reported that they could trace as great an actual saving to it as any piece of machinery on the farm.

The Deckman-Duty Brick Co. and the Wooster Shale Brick Co. have merged under the name of the Medal Paving Brick Co., with Spencer M. Duty, Charles J. Deckman and Herbert C. Moatz of the former company as president, vice-president and treasurer, and W. R. Barnhart and F. E. Schultz of the latter company as secretary and director. The company will operate its plants at Cleveland, Carrollton, Malvern and Wooster, Ohio, with general offices at 1305 Swetland building, Cleveland, Ohio.

The Dunn Wire-Cut-Lug Brick Co. of Conneaut, Ohio, has had two prominent additions to its family of licensees, the Burton-Townsend Co. of Zanesville, Ohio, with two plants and a present daily capacity of 160,000 pavers, and the Trimble Paving Brick Co. of Dayton, Ohio, with one plant at Trimble, Ohio, and another at Glouster, Ohio. These two companies are among the largest and most prosperous in Ohio. In addition, the Deckman-Duty Brick Co. of Cleveland, Ohio, another Dunn licensee, has consolidated with the Wooster Shale Brick Co. of Wooster, Ohio, under the name of the Medal Paving Brick Co. This adds one more plant to the three which the Deckman-Duty Co. owned—one at Cleveland, Ohio, one at Carrollton, Ohio, and one at Malvern, Ohio. These accessions give the Dunn Co. twenty-eight licensees, operating forty-five plants.

One point made for the segment block for sewers, made by the American Sewer Pipe Co., Akron, Ohio, is that it can be laid at any time, including cold weather, as the amount of mortar required to set it is so small that the expense of heating materials to prevent freezing is very small.

Trade Publications

Kahn mesh for reinforcing concrete is computed and designs are given for all sorts of work, with full tables of properties and sizes in a booklet of the Trussed Concrete Steel Co., Youngstown, O.

Studebaker delivery wagons are shown in full detail of construction, parts and prices, in Catalog No. 1001 of the Studebaker Corporation, South Bend, Ind.

Bulletin No. 216 of the Chicago Pneumatic Tool Co. is devoted to Hummer self-rotating hammer drills which, among other uses, are suitable for road building, trench work, breaking boulders and quarrying.

One of the set of standard specifications published and distributed by Robert W. Hunt & Co., engineers of inspection and test, Chicago, is that for paving brick adopted by the American Society for Testing Materials.

The Harris Municipal Garbage Incinerator and Steam Generator Co., Nashville, Tenn., is distributing to city officials and others interested in the sanitary and economical disposal of garbage and refuse, a booklet giving plans and specifications for the Harris incinerator and the guarantees offered as to work done and cost of disposing of the garbage. Mr. Harris offers sufficient and satisfactory bonds that his plant will produce the results which he promises.

The Palmer-Moore trucks and their special advantages in use for busses, jitneys and light truck work, such as delivery trucks, ¾ to 1-ton capacity, are set forth in booklets issued by the Palmer-Moore Co., Syracuse, N. Y.

There has just been issued by the Bureau of Standards, of the Department of Commerce, a paper dealing with the factors which influence resistivity of the soil and with the effects of soil resistance on the leakage of currents from street railway lines using the rails as return conductors. Three methods of determining the specific resistance of soil are given and the results of a large number of measurements are tabulated. The principal factors which influence soil resistance are described and their effects on the results of electrolysis surveys and on the escape of currents from street railway tracks are discussed. Copies of the publication, Technologic Paper No. 26, entitled "Earth Resistance and Its Relation to the Electrolysis of Underground Structures," may be obtained free of charge upon application to the Bureau of Standards, Washington, D. C.

Report of Board of Park Commissioners of Cincinnati, O., for 1914. C. H. Meeds, park engineer.

"City Government by Commission," published for the National Municipal League by D. Appleton & Co., New York, at $1.65, is edited by Clinton Rogers Woodruff, secretary of the league and gives the history and development of the system down to the present time.

The Whalen Form for concrete culverts is exploited in a fully illustrated circular from the office in Syracuse, N. Y.

Irrigation by pumping at Del Rio, Tex., is the subject of a number of reprints of articles from engineering periodicals describing the first large American installation of the Humphrey direct-acting explosion pump on a private estate, the system being designed by Alexander Potter, consulting engineer, New York, for the G. Beddell Moore estate.